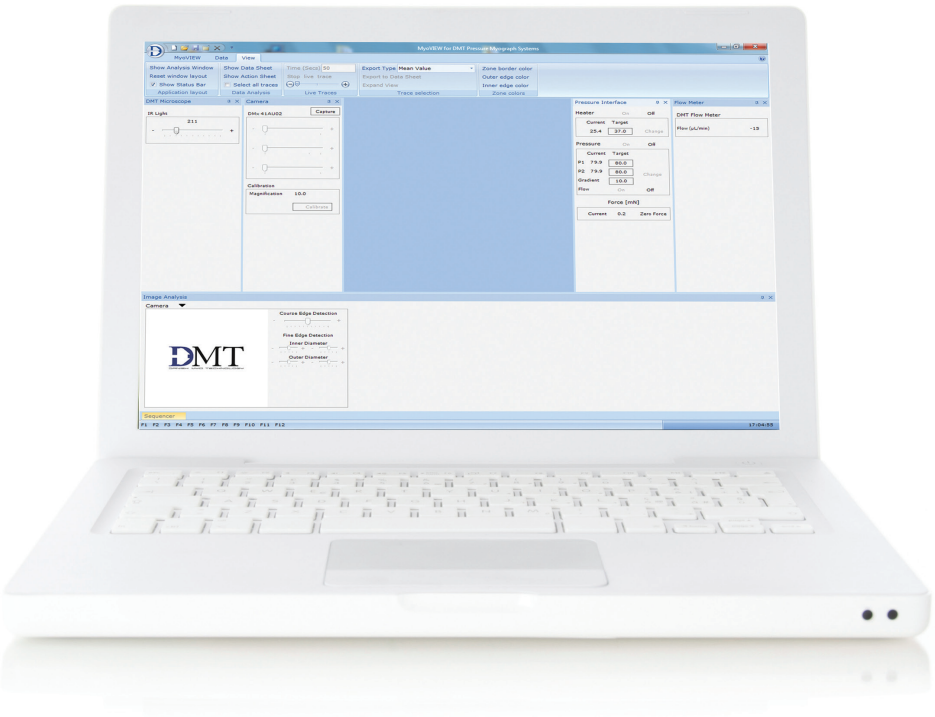
DMT
DANISH MYO TECHNOLOGY

MYOVIEW

USER MANUAL



User Manual

Version 1.0

TRADEMARKS

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Changes may have been made to the software and hardware it describes since then.
New information may be supplied separately.

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CHAPTER 1 - START UP

The DMT Pressure Myograph Systems is primarily operated via the MyoVIEW software. The function of the software is to control the heat of the chamber, the pressure and the trace recording of following parameters:

- Left Wall Thickness
- Right Wall Thickness
- Average Wall Thickness
- Outer Diameter
- Inner Diameter
- Vessel Area
- Lumen Area
- Cross Sectional Area
- Media/Lumen Ratio
- Shear Stress (optional)
- Inlet Pressure
- Outlet Pressure
- Mean Pressure
- Flow (optional)
- Vascular resistance (optional)
- Temperature
- Force (longitudinal)
- pH (optional)

1.1 MyoVIEW Start up on your computer

Go to Start -> All Programs -> DMT -> MyoVIEW

NOTE
RIGHT CLICK ON MYOVIEW AND SELECT "SEND TO" TO CREATE A MYOVIEW SHORTCUT ON YOUR DESKTOP.

MyoVIEW will start up with the layout from last time MyoVIEW was used. The following MyoVIEW screen will now be visible on the screen (see figure 1.1 or 1.2):

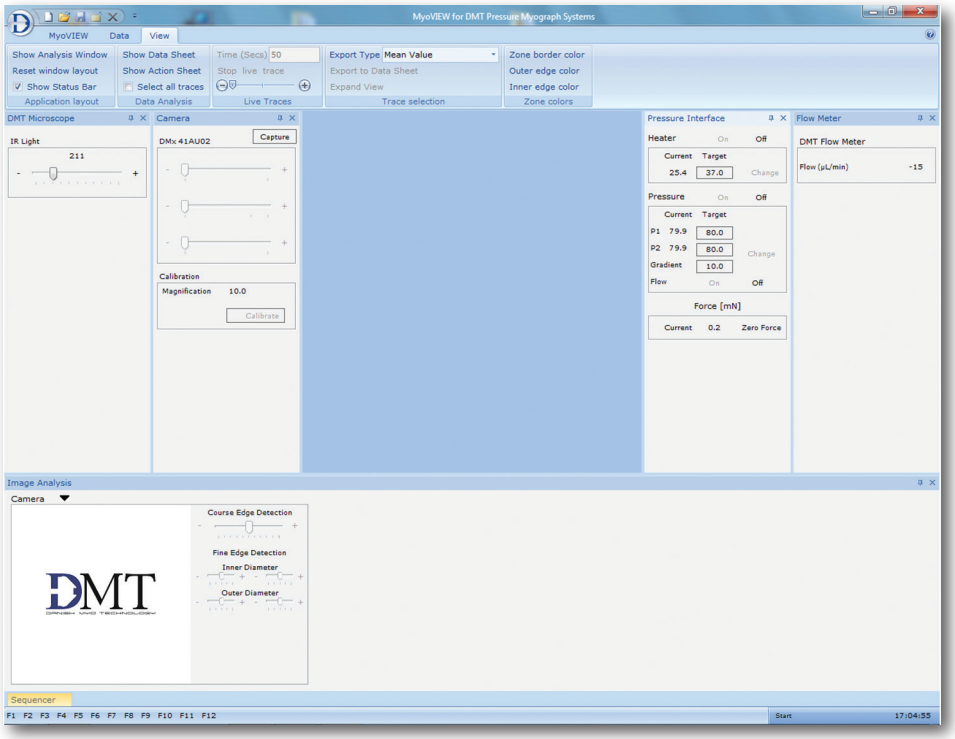


Figure 1.1 *Example of MyoVIEW start screen with DMT microscope attached*

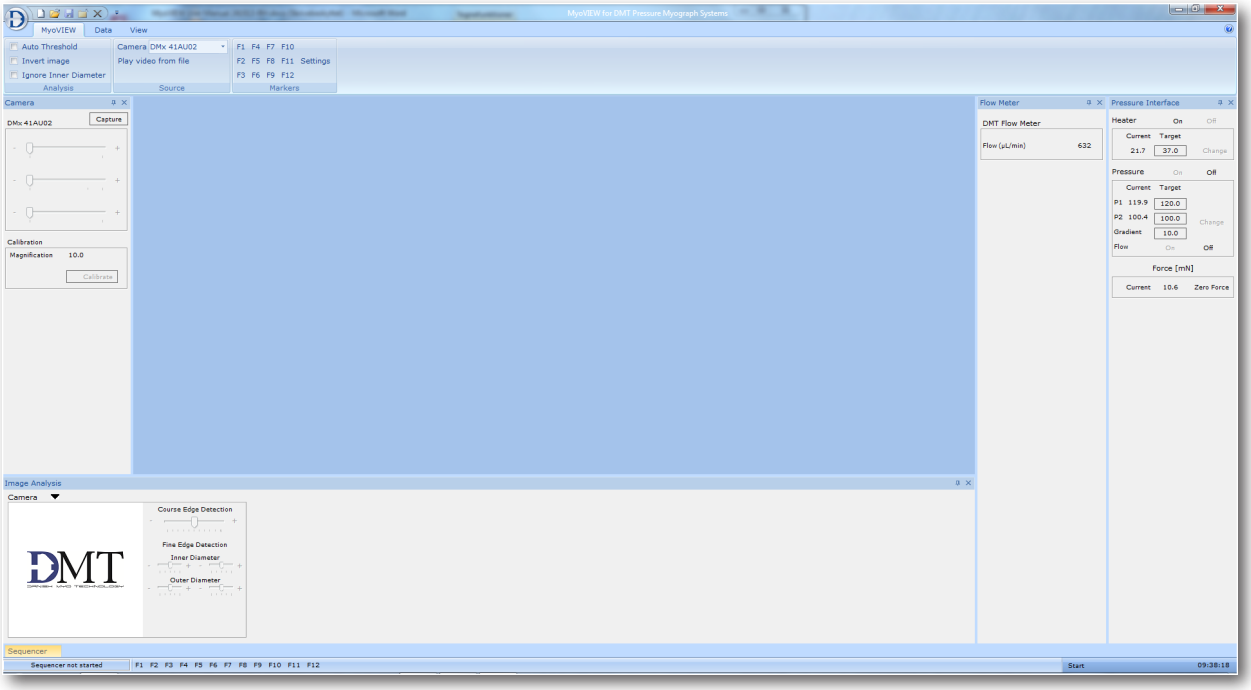


Figure 1.2 *Example of MyoVIEW start screen without DMT microscope attached*

1.2 Layout

The layout on the screen can be simplified by hiding the different small windows for the DMT Inverted Microscope (or video from normal inverted microscope e.g. Zeiss), Camera, Pressure Interface, Image Analysis, Sequencer and Flow Meter (optional). By clicking the needle-pin icon in the top right hand corner (marked in figure 1.3 below) the windows will hide either on the left or right hand side of the MyoVIEW screen.

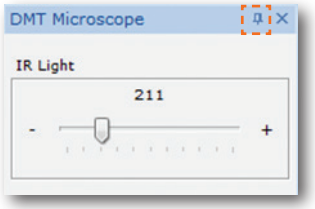


Figure 1.3 *Indication of needle-pin icon*

After hiding the five different windows the MyoVIEW layout will look like this:

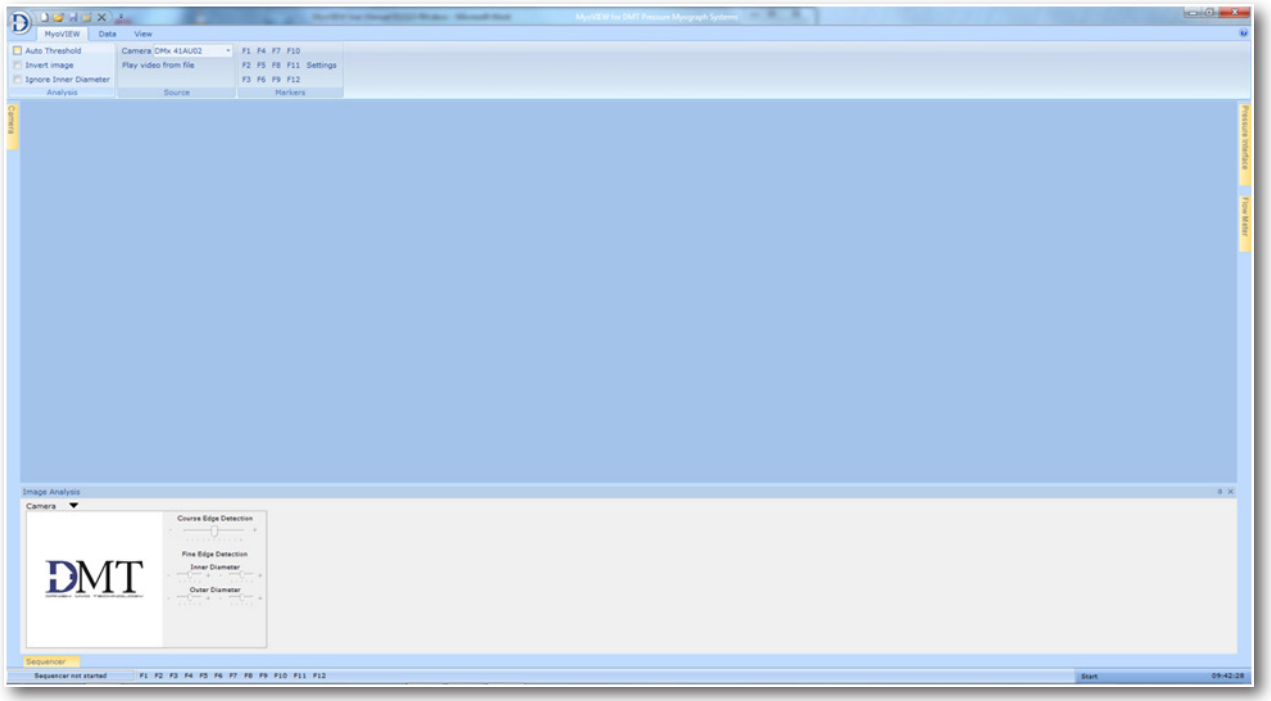


Figure 1.4 *Layout after hiding the windows*

The five different windows will slide in if requested and be visible by holding the mouse pointer on the yellow tab. By pressing the needle-pin again the window will stay open and not be hidden, see figure 1.5, A-B below.

Vertical needle-pin: The Camera Menu will NOT be hidden.
Horizontal needle-pin: The Camera Menu will be hidden.

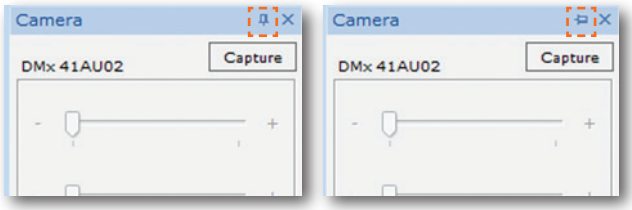


Figure 1.5, A-B *Indication of vertical needle-pin icon (left) and horizontal needle-pin icon (right)*

The **Image Analysis window** showing the video from the USB camera can be moved around and resized as required. Simply holding down the left mouse button on the **Image Analysis window** and drag it to the requested position on the screen. At the given position the size of the **Image Analysis window** can be scaled up and down, see figure 1.6 and 1.7.

The layout in MyoVIEW is extremely flexible and user friendly. MyoVIEW saves the given layout shown on the screen when the program is closed.

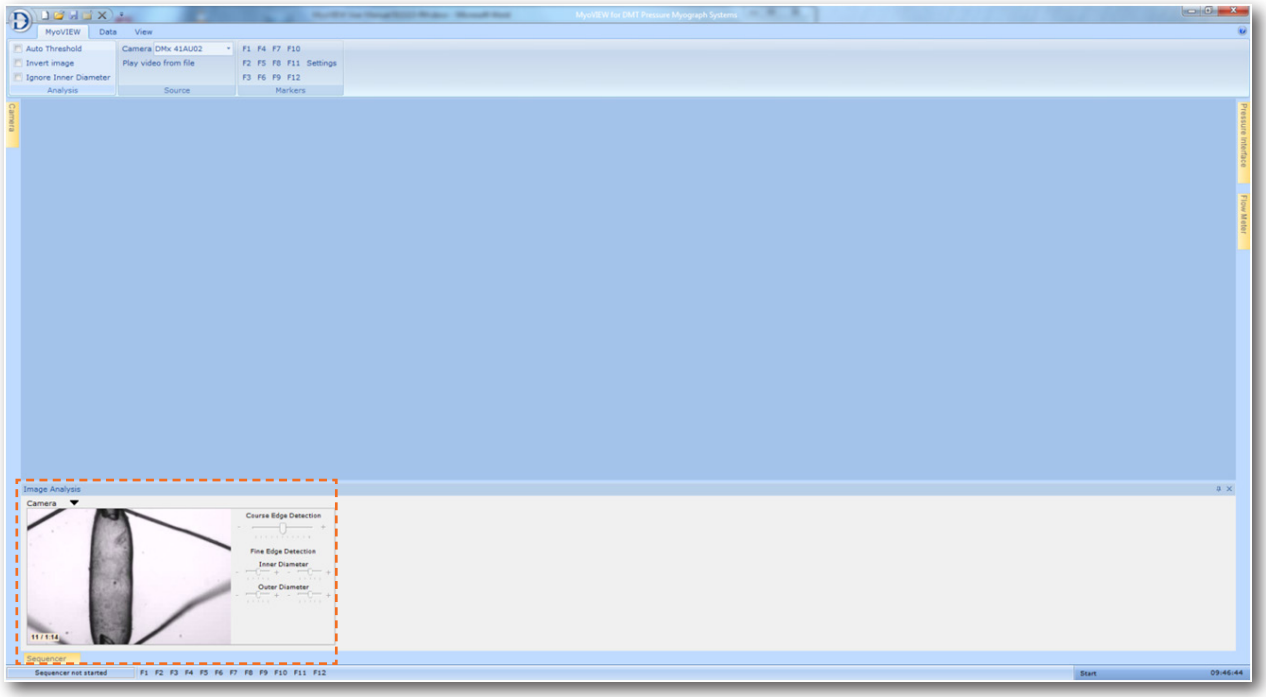


Figure 1.6 *Image Analysis window at the buttom of the MyoVIEW screen*

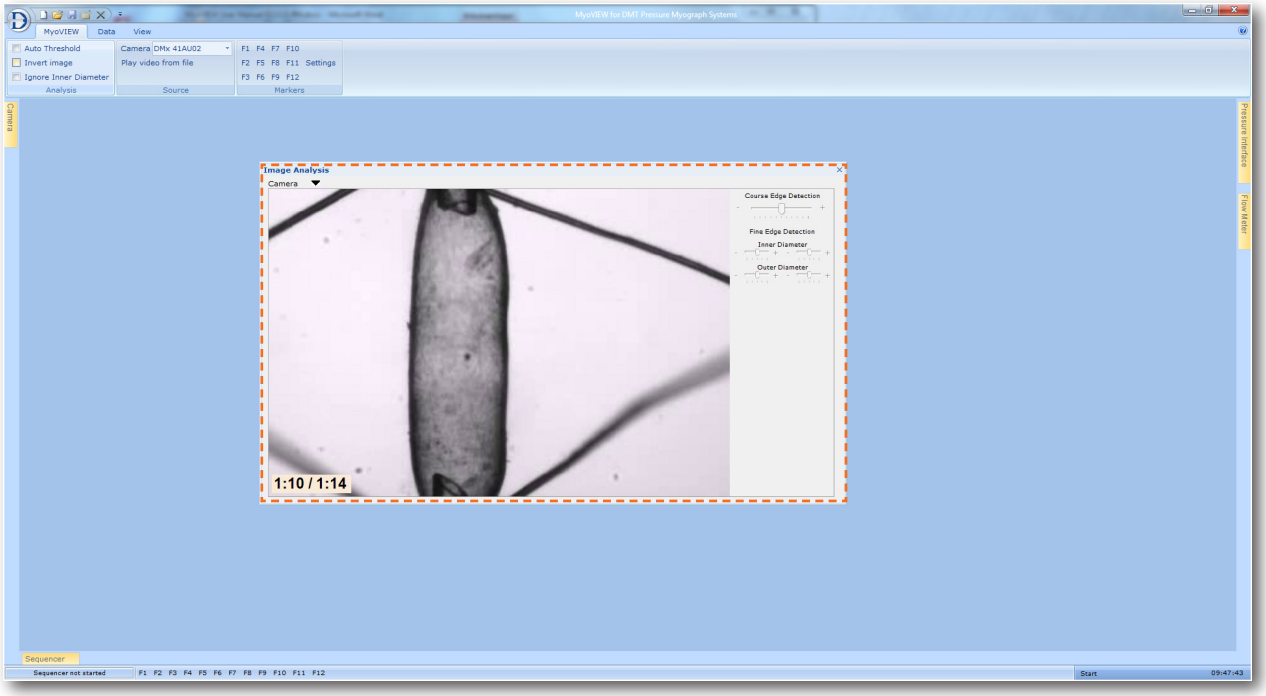


Figure 1.7 *Image Analysis window moved and resized at the center of the MyoVIEW screen*

1.2.1 Reset of the MyoVIEW layout

At any given time the layout can be set to default by going to the **View Menu** and click on the **Reset window layout**.

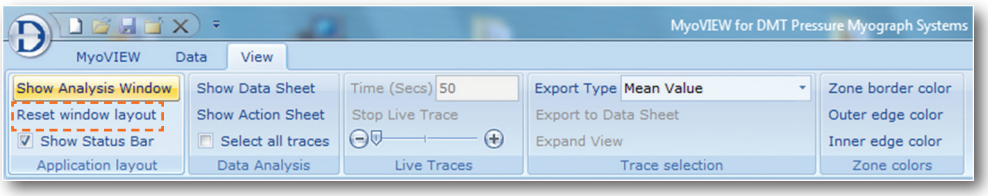


Figure 1.8 *"Reset window layout"*

CHAPTER 2 - CONTROL WINDOWS

The MyoVIEW control windows control the Camera, the Image Analysis, the Pressure Interface, the Sequencer, FlowMeter (optional) and DMT Inverted Microscope (optional).

2.1 Camera Control Window

The capture of video images from the video camera is activated by pressing CAPTURE (marked in figure 2.1 A below) and stopped again by pressing STOP (marked in figure 2.1 B below) in the **Camera control window**. The Brightness, Gamma and Gain of the camera can be adjusted using the appropriate sliders (see figure 2.1 B below) to obtain a good image of the mounted vessel.

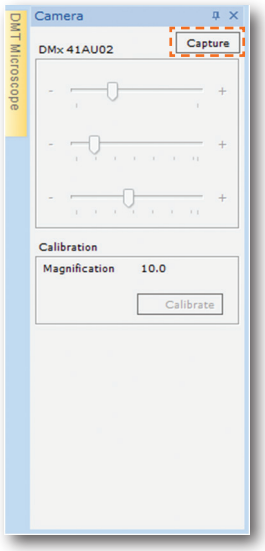


Figure 2.1 A *Camera control window - Capture*

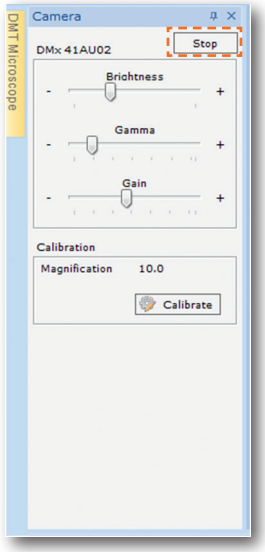


Figure 2.1 B *Camera control window - Stop*

The best image to obtain a good tracking of the vessel walls is images in the grayscale area and not very bright images showing a black and white image. Keep the light and brightness to the lower side and keep the image in the grayscale instead of a very bright image resulting in a completely white background. The latter will result in poor quality tracking of the wall, see examples in figure 2.2 A-B below.

Figure 2.2 A *Good image for tracking of the vessel wall*

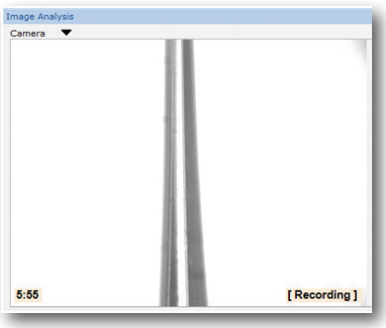


Figure 2.2 B *Too bright image and the tracking will not be good.*

2.2 Calibration of the camera

It is very important that the camera is calibrated to obtain the pixel/µm relationship for the objective used on the given camera. Once the camera is calibrated with the given objective the calibration data will be saved in MyoVIEW. A new camera calibration is only performed if the objective or camera is changed or never have been used before.

1. Press CAPTURE in the **Camera Control Window** to start the **Video Capture.**

2. Place the supplied micrometer ruler on the microscope and adjust the microscope to get the ruler in focus. DMT Inverted Microscope users place the micrometer ruler on the supplied micrometerpositioner ruler adaptor as shown in the picture below.

Figure 2.3 *Placing the micrometerpositioner ruler on DMT Inverted Microscope*

3. To calibrate the camera press the **Calibrate icon** in the **Camera Control window** (marked in figure 2.4 below).

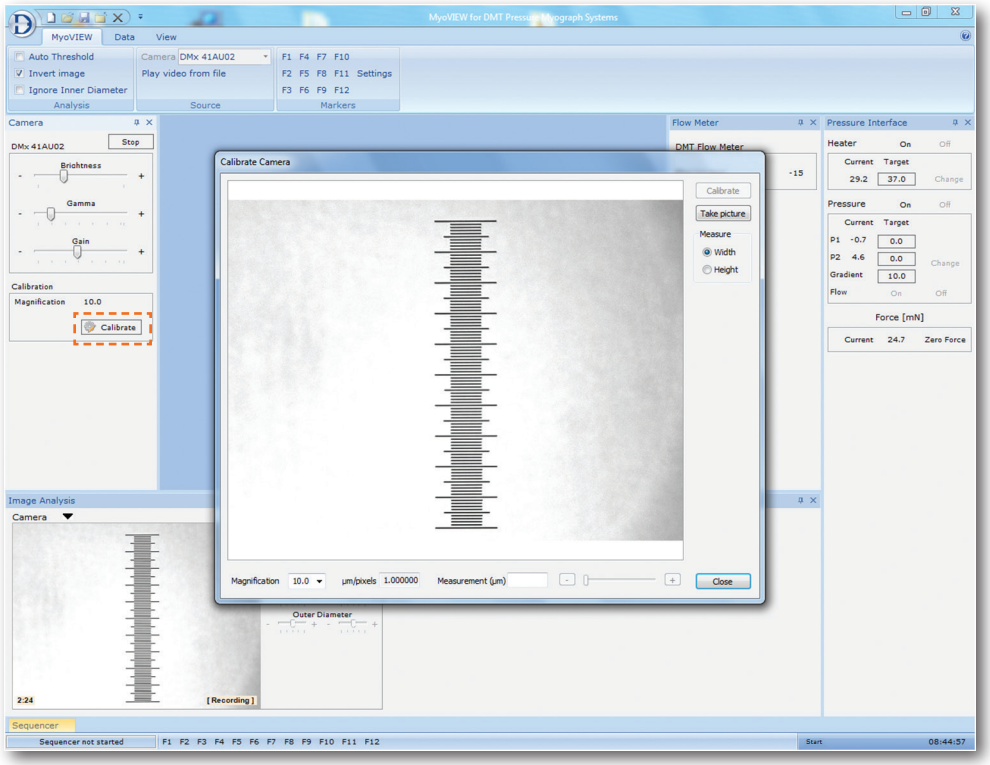


Figure 2.4 *Camera Control window - Calibrate Camera*

4. The micrometer ruler will now be displayed on the screen. Select the **Magnification** (marked in figure 2.5 below) corresponding to the objective used on the microscope.

5. Draw a box covering the 1000µm ruler exactly as shown in figure 2.5 (red box) below using the mouse holding the left mouse button down. The appearing red box with the tick marks can be rotated 90 degrees by clicking either the **Width** or **Height** on the right hand side (marked in figure 2.5 below) to be able to get the red box to fit the ruler (for every 200µm), see figure 2.6 below.

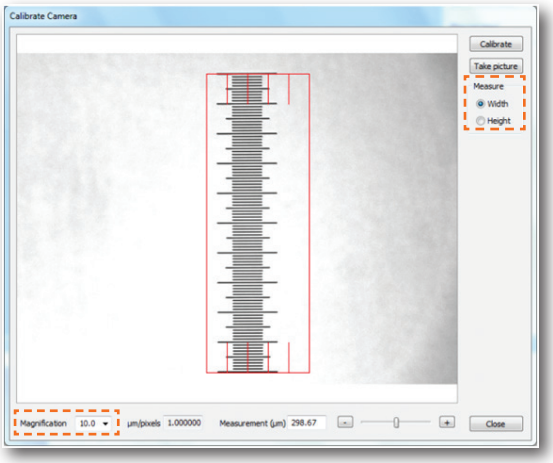


Figure 2.5 *Calibrate Camera - micrometer ruler*

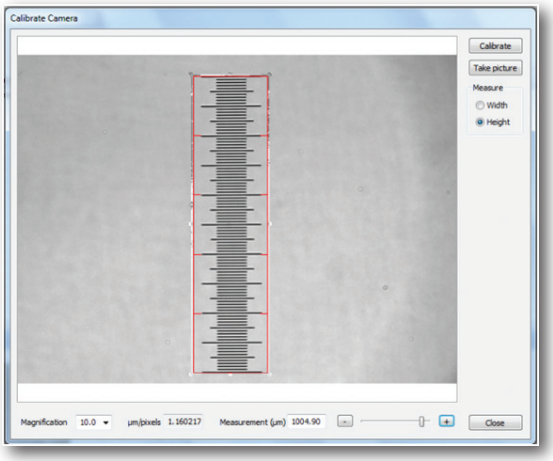


Figure 2.6 *Calibrate Camera - micrometer ruler - rotated 90 degrees*

6. Fine adjust the red box tick marks by clicking on the plus and minus slider (marked in figure 2.7) until it fits exactly.

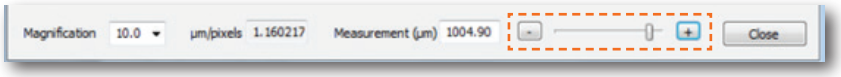


Figure 2.7 *Plus and minus slider*

7. Click on **Calibrate** and fill in the number of µm the red box covers into the box **Enter measured microns**. Press the ENTER key to save the calibration of the camera; in this case it is 1000µm (see figure 2.8).

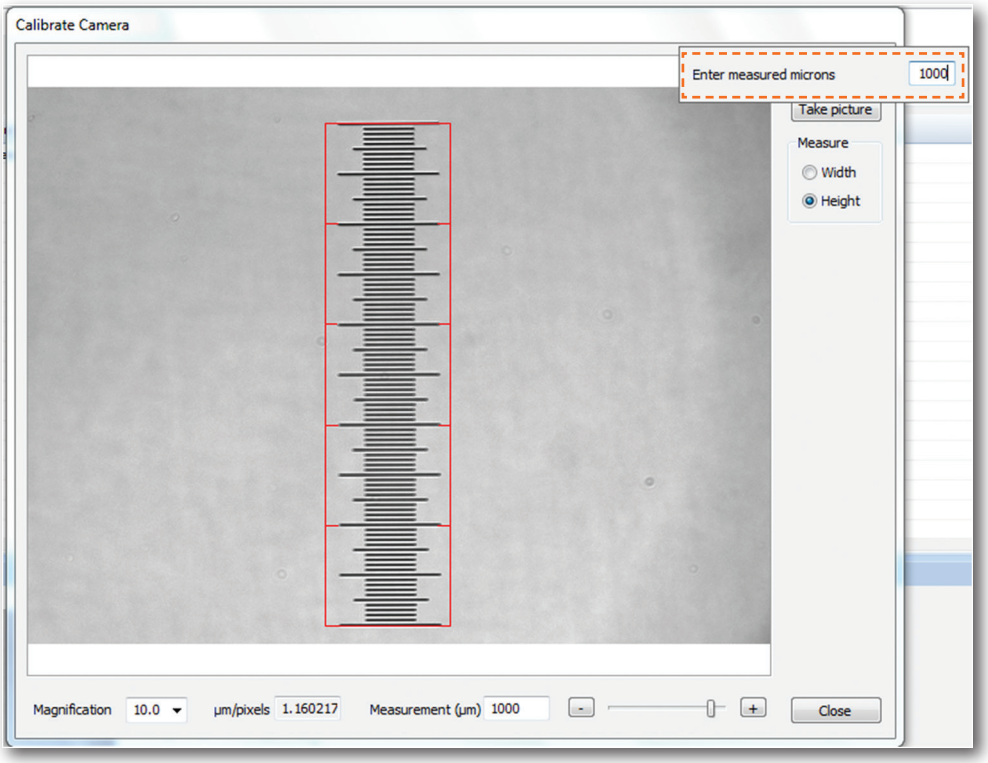


Figure 2.8 *Enter measured microns*

8. In the box **Measurement (µm)** (marked in figure 2.9 below) the camera will now show how many µm the red box covers. This value should in this case be 1000µm. By resizing the red box the calibration of the camera can be controlled by reading the number in the **Measurement (µm)** when the red box is resized.

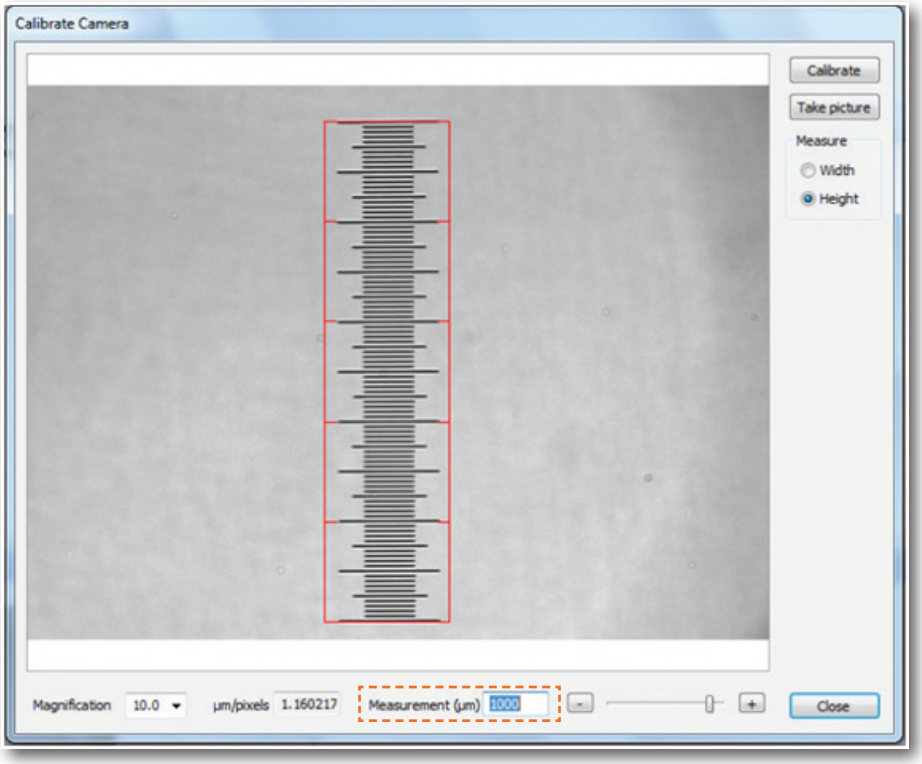


Figure 2.9 *Measurement (µm) box*

The camera calibration will be saved as an 'action' in the **Action Sheet** to document that the camera calibration has been performed. In the example shown below we have calibrated the camera three times just for illustration.

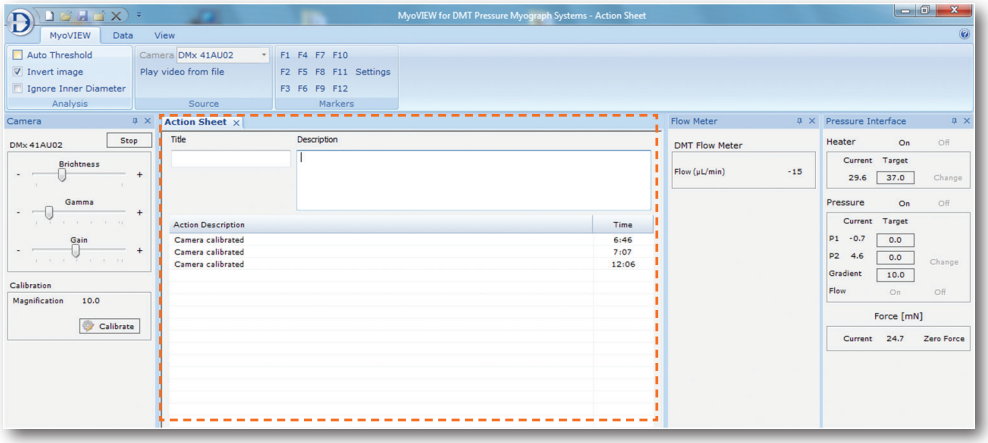


Figure 2.10 *Action sheet - illustration of saved calibration of the camera*

2.3 Image Analysis Control Window

The **Image Analysis Control window** is showing the video of the mounted vessel. This video image is used to measure and calculate the parameters recorded in MyoVIEW.

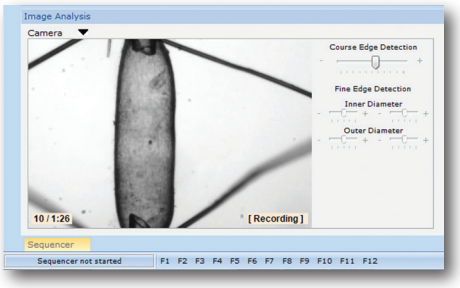


Figure 2.11 *Image analysis control window*

2.3.1 Zones

Before MyoVIEW can calculate the dimensions of a mounted vessel the user has to define a region wherein MyoVIEW will track the vessel wall and calculate all the parameters. In MyoVIEW a zone is placed by left clicking and dragging a box across the video image of the vessel in the **Image Analysis Control Window** (marked in figure 2.12[1] below). MyoVIEW can handle up to two zones. In each zone all the parameters are tracked, measured and calculated individually. Each zone will have a number (1 or 2). In figure 2.12 below two zones have been placed and in the left side of the trace window a 1 and 2 can be seen representing zone 1 and zone 2, respectively (marked in figure 2.12[2] below). To see the trace of a parameter from zone 1 click on the **1** and then select the parameter to be shown by right clicking on the trace (see figure 2.13).

When the measuring zone is placed on the video image of the vessel in the **Image Analysis Control Window** a Trace recording will be opened automatically (see figure 2.12[3] below) without any selected parameter (if not opened manually before).

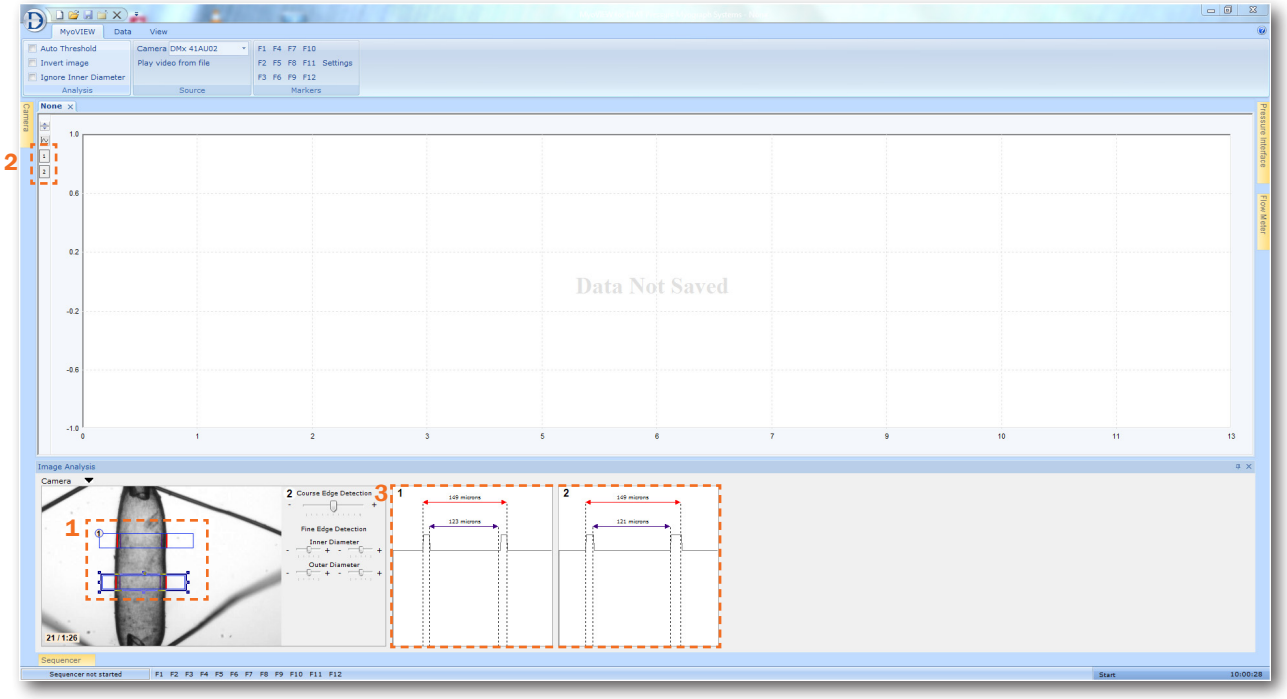


Figure 2.12 *Image Analysis Control Window - Trace recording*

Right click on the trace to select the parameter as shown below.

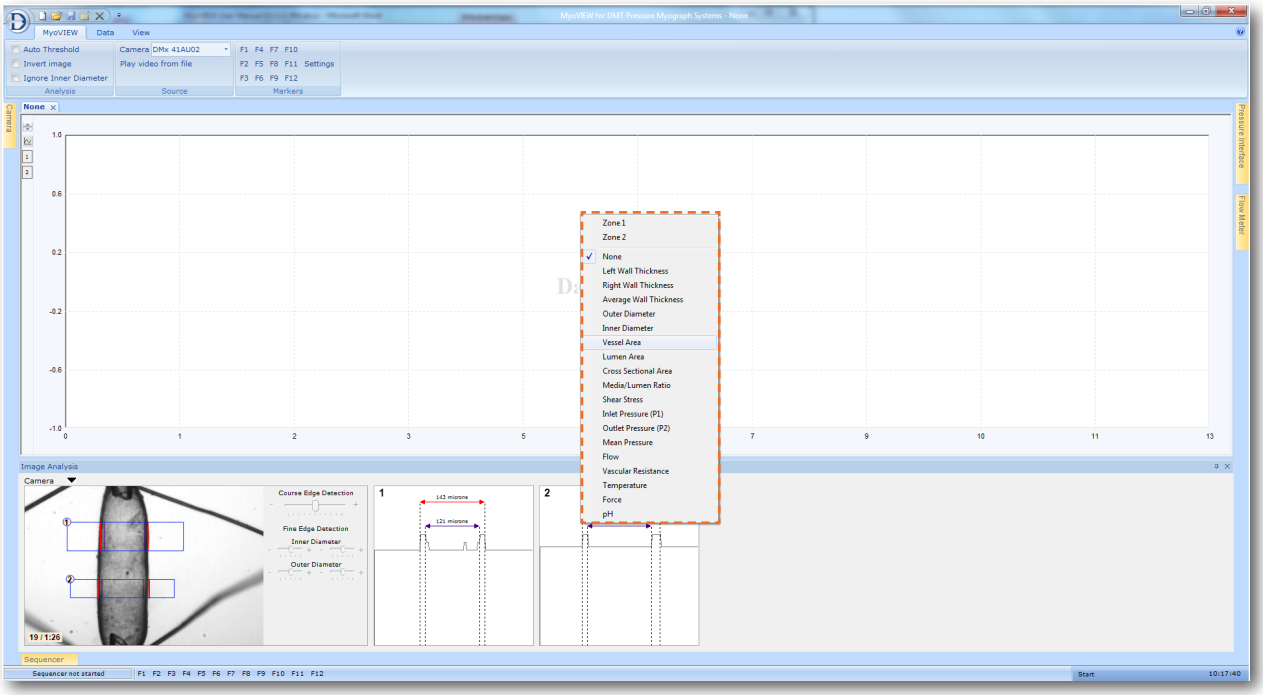


Figure 2.13 *Select a parameter*

Trace data of a given parameter from zone 1 or zone 2 is selected by clicking on the small box **1** or **2** on the left hand side of the trace marked below.

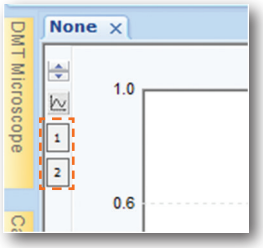


Figure 2.14 *Zone 1 and Zone 2 - Select the zone to be shown*

The zones can be moved, enlarged or minimized as needed by dragging the box. As soon as the box is placed the wall tracking algorithm in MyoVIEW will start trying to track the inner and outer wall of the vessel. The red line will show the tracking of the outer wall and the green lines will show the tracking of the inner wall. To the far right in the **Image Analysis Control window** the outer (red lines) and inner diameter (green lines) are shown for the two zones, see figure 2.15 below.

If the tracking of the inner and outer wall is not correct then the algorithm can be fine tuned by highlighting the zone box and thereafter change the **Course Edge Detection** using the slider or the minus and plus sign in the **Image Analysis Control window** as marked in figure 2.15 below until the tracking of the inner and outer wall is perfect (see figure 2.16).

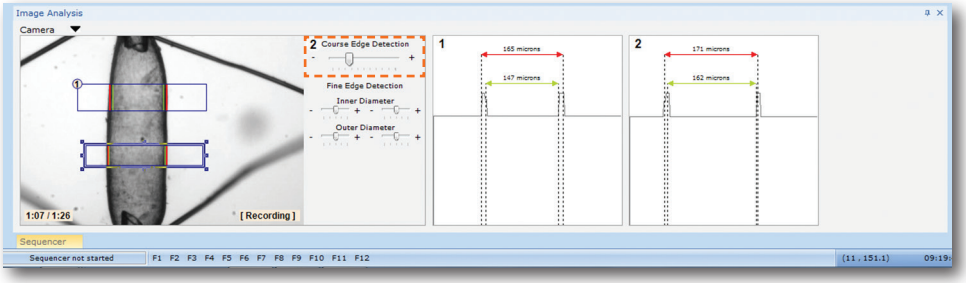


Figure 2.15 *Use the Course Edge Detection Slider to adjust the tracking*

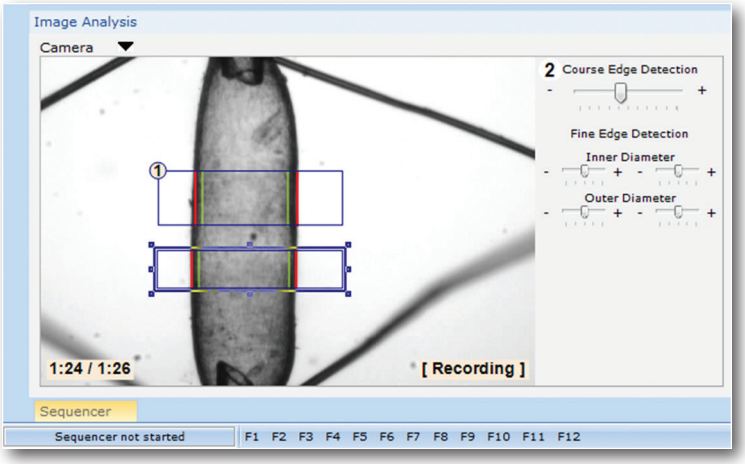


Figure 2.16 *Here the slider Course Edge Detection has been changed for zone 2 to get a better tracking of the vessel walls.*

In cases where connecting or fat tissue can not be removed perfectly from the vessel the tracking of the walls could be a problem for the tracking algorithm. In these cases the **Fine Edge Detection sliders** in the **Image Analysis Control window** is used (see figure 2.17 below). There is one slider for each of the four tracking lines. By sliding the **Fine Edge Dection bar** offset values are added or subtracted to the tracking algorithm and thereby the user will be able manually to place the tracking line to the position where the user can see the wall even though there is a lot of connecting tissue attached to the vessel.

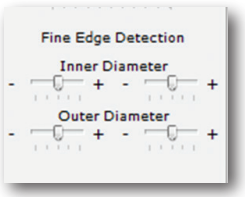


Figure 2.17 *Fine Edge Dection*

2.3.2 Tracking problems and solutions

1. If there is a problem with the tracking even after changing the **Course Edge Detection** parameters then try to change the camera gain and brightness combined with the **Course Edge Detection** parameters. Adjusting the light intensity on the microscope is also an option to get a better tracking of the vessel walls.

2. Very large/thick vessels are too thick to light through making it impossible to track the inner diameter. An example would be rat aorta. In this case select **Ignore Inner Diameter** in the MyoVIEW Menu. MyoVIEW will then only track the outer diameter.

3. The vessel is not clean: The vessel has some connecting tissue and fat attached making it impossible to track the right position of the wall.
   A. Try to move the zone to another position.
   B. Use the **Fine Edge Detection** sliders in the **Image Analysis Control window**.
   C. Clean a new vessel and mount it in the Myograph chamber.

2.3.3 Reset Fine Edge Dection sliders

The **Fine Edge Detection** sliders can be reset by going to the **Image Analysis control window** and click on the camera and then select **Reset Fine Edge Detection** as shown in the figure 2.18 below.

2.3.4 Snapshot image of the mounted vessel

Go into the **Image Analysis control window** and click on the camera and select **Export image to file** as shown in the figure 2.18 below.

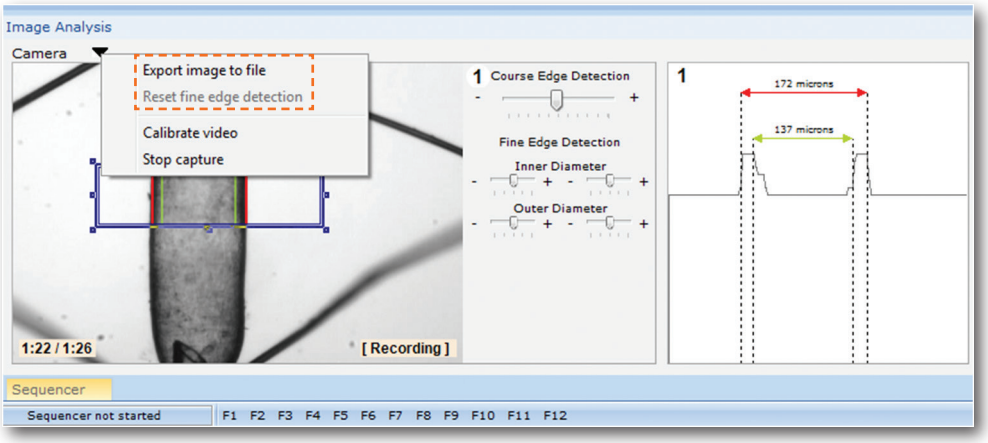


Figure 2.18 *"Reset Fine Edge Detection" and "Export image to file"*

2.4 Pressure Interface Control Window

The **Pressure Interface Control window** is placed along the right side of the MyoVIEW layout as shown in the figure below. The **Pressure Interface Control window** is divided into three parts; **Heater control, Pressure Control** and **Force control.**

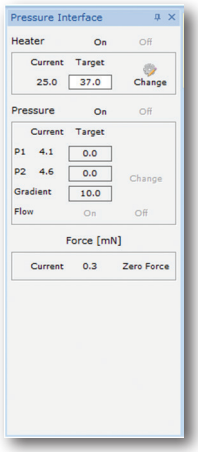
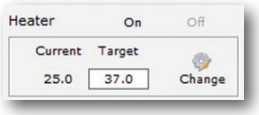


Figure 2.19 *Pressure Interface control window*

2.4.1 Heater Control

Control the temperature in the Myograph Chamber and Pressure Interface buffer bottles. Enter the temperature of choice (RT to 50 C) and press ENTER on the keyboard or click the **Change icon**. To turn the heat on and off click the **On** and **Off icon** respectively.



2.21 *Heater control*

2.4.2 Pressure Control

- **Pressure On/Off** - To pressurize the bottles in the Pressure Interface click on the **On icon** and to turn off the pressure on the bottles in the Pressure Interface click on the **Off icon**.

  NOTE
  WHEN MYOVIEW OPENS THE PRESSURE IS ALWAYS OFF AS A DEFAULT.

- **P1** and **P2** - Setting of the pressure at the P1 and P2 side of the chamber. Enter the pressure of choice at the P1 and P2 side (0-250mmHg and press the ENTER key or click the **Change icon** to save the entered values. To prevent backflow MyoVIEW will not accept a higher P2 pressure than P1 pressure.

- **Gradient** - The Pressure Interface can build up pressure with different speeds. The default setting is 10mmHg/sec meaning going from 40mmHg to 50mmHg takes 1 sec. The speed/gradient can be changed between 1mmHg/sec and 10mmHg/sec

- **Flow On/Off** - Inside the Pressure Interface a valve will normally be closed blocking the flow coming from the P2 side of the chamber and create a no-flow situation (Simulate Blind-sac experiment). The flow is turned on by a click on the **On icon** and off by a click on the **Off icon**. In the no-flow state only the Pressure entered as the P1 value will be applied to the mounted vessel.

  NOTE
  WHEN MYOVIEW OPENS THE FLOW IS ALWAYS OFF AS A DEFAULT.

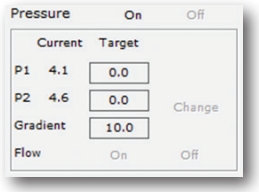


Figure 2.22 *Pressure control*

2.4.3 Force

- **Zero** - The force transducer measuring the longitudinal force generated by the mounted vessel is calibrated as described in the Pressure Myograph Systems User Manual. In MyoVIEW the zero is used to zero the force of the force transducer. Besides using the force transducer for measuring the longitudinal force generated during an experiment the force transducer can also be used for normalizing the vessel during mounting of the vessel. To make sure that all vessels are strectched equally each time the force can be used to put the same stretch/force to the vessel before starting an experiment.

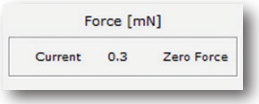


Figure 2.23 *Force*

2.5 Sequencer Control Window

The Sequencer in MyoVIEW is a feature to program the Pressure Interface to define pressures after a defined time period. A sequence will normally contain several steps/programs/tasks. The sequencer is found at the bottom of the MyoVIEW Layout, see figure 2.24 below.

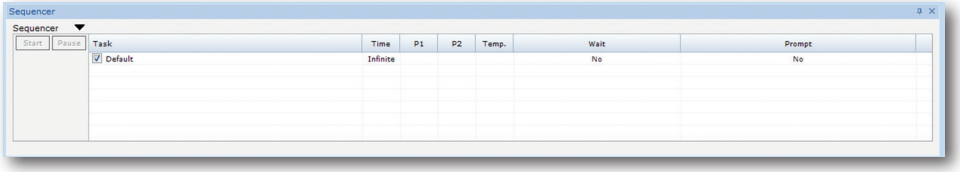


Figure 2.24 *Sequencer control window*

Adding Task steps to the sequencer:

1. Click on the sequencer triangle icon and select **Add task** (see figure 2.25).

2. The Task manager (see figure 2.26)
   Several information are needed for each task to be filled in.

   - **Description:** Free text describing the task.
   - **Show description on trace when task starts**: If this is selected the free text from Description will be written on the traces when the task starts (see figure 3.18).
   - **Duration:** Time in seconds the task should run before continuing to the next task.
   - **Inflow (P1):** Target pressure in mmHg for the P1 (0-250mmHg).
   - **Outflow (P2):** Target pressure in mmHg for the P2 (0-250mmHg).
   - **Temperature (C):** Chamber temperature (RT-50 °C).
   - **Prompt user:** When the task ends the sequencer will prompt the user for an OK with the text written into the text box before it will continue to the next task. In figure 2.26 the text 'Add Drug 1' have been added. This results in a prompt box with the text 'Add Drug 1' that the user has to click OK before the sequencer continue to next step.
   - **Wait:** A tick mark in the **Wait box** (See figure 2.27) means that the task will continue for 10 seconds as listed and then check if the pressure at P1 has reached 40mmHg if not the task will continue until the 40mmHg has been reached.

3. Enter all the tasks needed in the sequencer and click OK. The sequencer tasks are listed in the trace as marks, marked in figure 2.28 below.

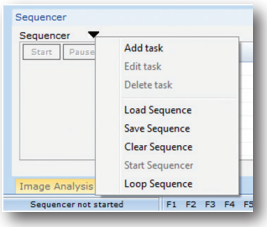


Figure 2.25 *Sequencer drop down menu*

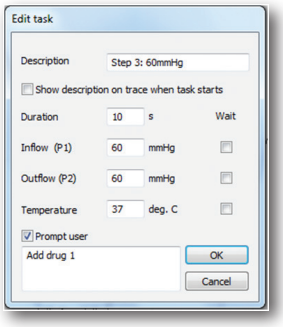


Figure 2.26 *Task manager*

Edit a Task: Double click on a task and the **Task Manager** will show the task to be edited. Alternative mark the task and select **edit task** in the drop down menu of the sequencer (see figure 2.25).

Delete a Task: Mark the task and select **delete task** in the drop down menu of the sequencer.

Load Sequence: Select **Load Sequence** in the drop down menu of the sequencer.

Save Sequence: Select **Save Sequence** in the drop down menu of the sequencer.

Clear Sequence: A sequence can be deleted. Select **Delete Sequence** in the drop down menu of the sequencer.

Loop Sequence: A sequence can be repeated again and again using the 'Loop Sequence' function. Select **Loop Sequence** in the drop down menu of the sequencer.

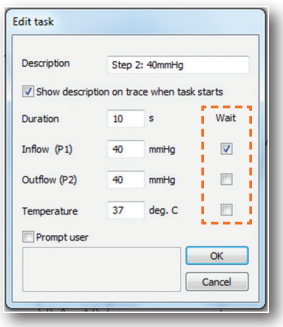


Figure 2.27 *Task manager - wait box*

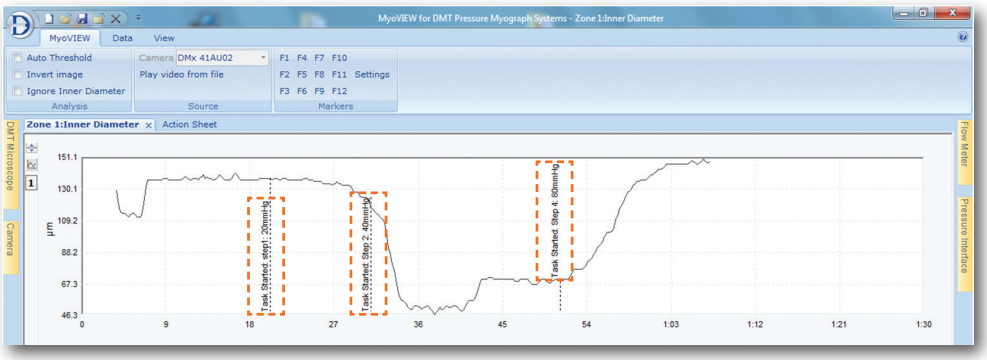


Figure 2.28 *Experiment using the sequencer.*
The sequencer tasks are listed in the trace as marks

2.6 Flow meter Control window (optional)

The DMT FlowMeter - 162FM is not an active flow meter able to control the flow. The FlowMeter is only at the moment able to measure the flow as a result of a pressure gradient across the vessel due to the value for P1 and P2.

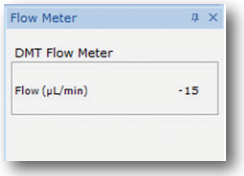


Figure 2.29 *DMT FlowMeter control window*

2.7 DMT Inverted Microscope Control Window (optional)

The **DMT Microscope Control window** shown below is used to adjust the Infrared Light (IR-light) intensity in the DMT Inverted Microscope. The IR-light can also be adjusted directly on the DMT Inverted Microscope turning the silver knob on the back of the microscope. The IR-light can be used to obtain the optimal contrast image of the vessel to track the vessel walls.

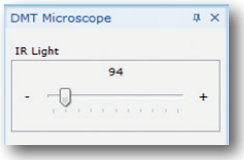


Figure 2.30 *DMT Microscope control window*

CHAPTER 3 - THE MYOVIEW MENUS AND CONFIGURATION

3.1 Application button (DMT logo)

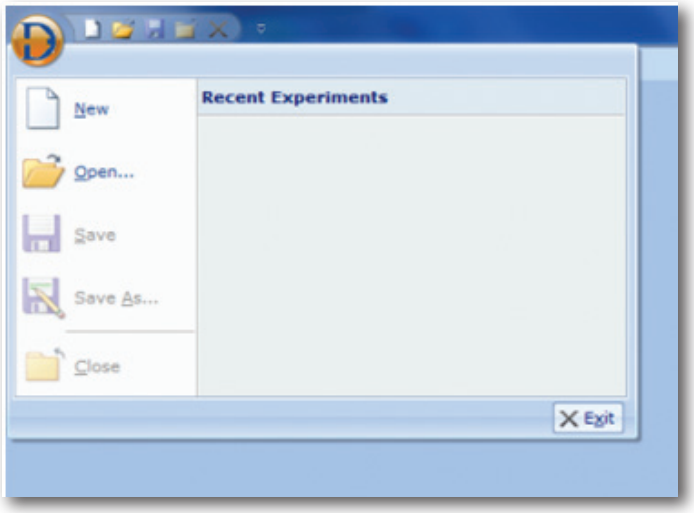


Figure 3.1 *Application button*

New trace: A new trace will be shown in MyoVIEW.

Open experiment: Open a saved MyoVIEW experiment.

Save experiment: Save the MyoVIEW experiment as a Myo file.

Close experiment: Close the MyoVIEW experiment.

Exit: Exit the MyoVIEW programme.

3.2 MyoVIEW Quick Access Toolbar

The MyoVIEW quick access tool bar is in the top left corner, see figure 3.2 below.

Figure 3.2 *MyoVIEW Quick Acces Toolbar*

Customize Quick Access toolbar: Customize the Quick Access Toolbar, see figure 3.3 below.

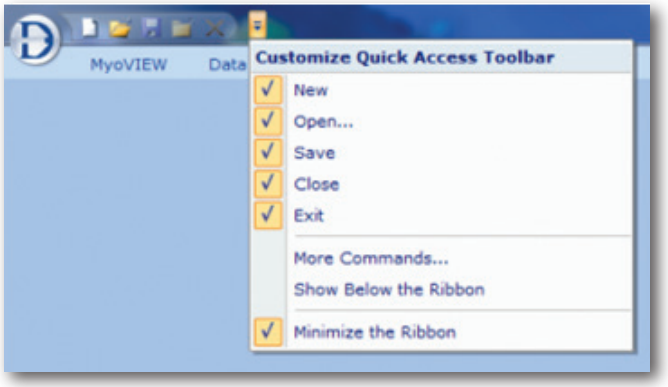


Figure 3.3 *Customize Quick Acces Toolbar*

3.3 New trace

By clicking the **New Trace Icon** (at the MyoVIEW **Quick Acces Toolbar**) a new trace will be shown in MyoVIEW. The new trace will not be dedicated to show any specific parameter before this is selected.

Before opening the first trace:

1. Select **Record Video** in the **Video Recording submenu** of the **Data Menu** if video of the experiment should be recorded and saved.
2. Start **Video Capture** in the **Camera Control Window**.
3. Mark one or two zones on the vessel to be recorded in the **Image Control Window**.

To select and show a trace of a specific parameter right click on the trace and the following will be shown, see figure 3.4 below.

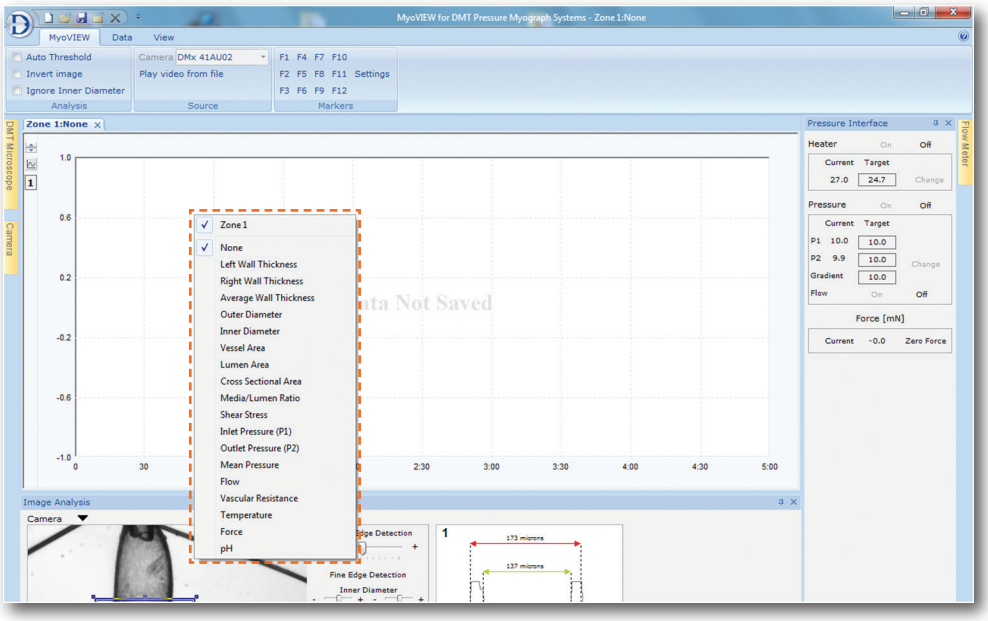


Figure 3.4 *Select parameter from drop down menu*

Select the parameter of interest. As many traces as requested can be opened and shown at the same time. The traces can be stacked as tabs, in columns or in rows. The trace layout can easily be arranged as requested simply by dragging the actual **Trace window** to the requested position. The three different layout are shown on the next pages in figure 3.6 - 3.8.

If the data traces cannot be seen on the screen then first click on **1** for showing zone 1 or **2** if two zones have been made on the video image (marked figure 3.5 below).

If the traces still can not be seen then the scale on the y-axis could be set wrong.

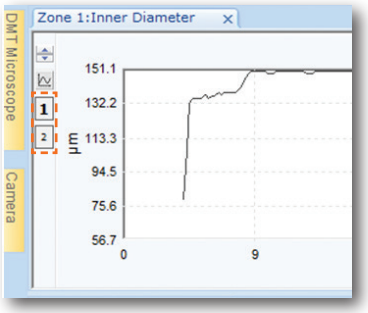


Figure 3.5 *Click for zone 1 or 2*

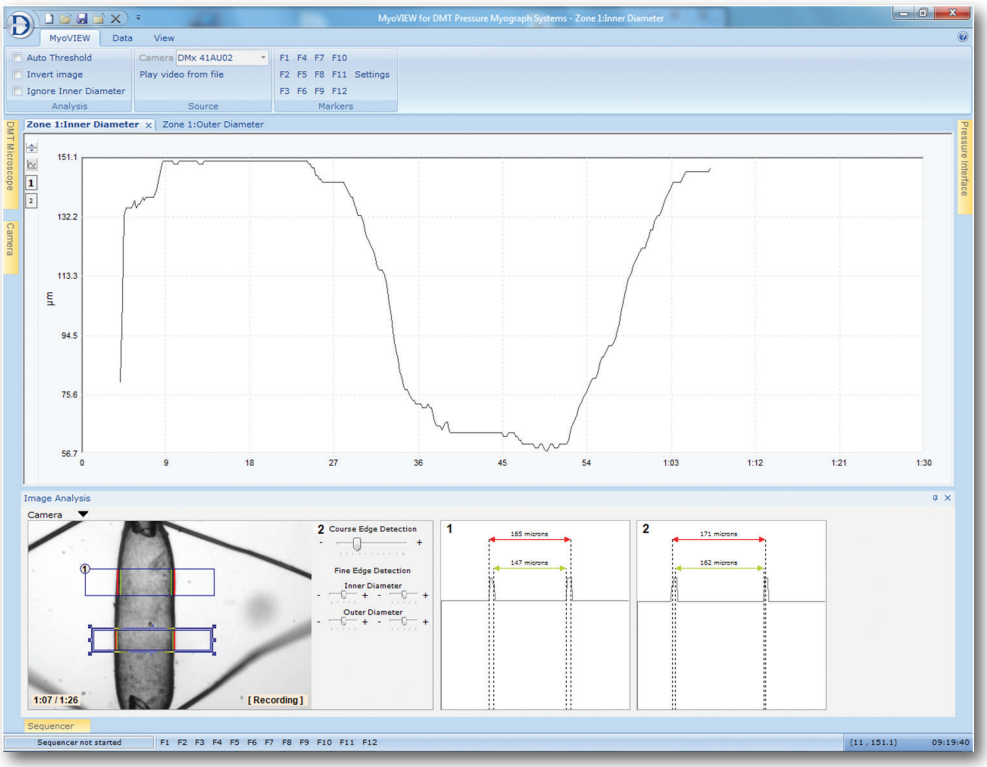


Figure 3.6 *Trace Layout 1 - Tab-layout*

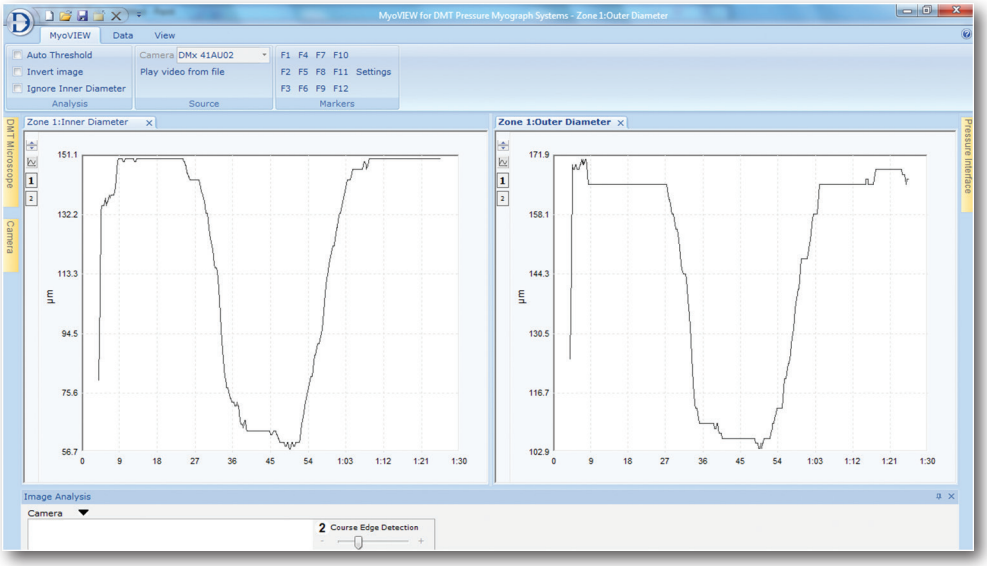


Figure 3.7 *Trace Layout 2 - Column Layout*

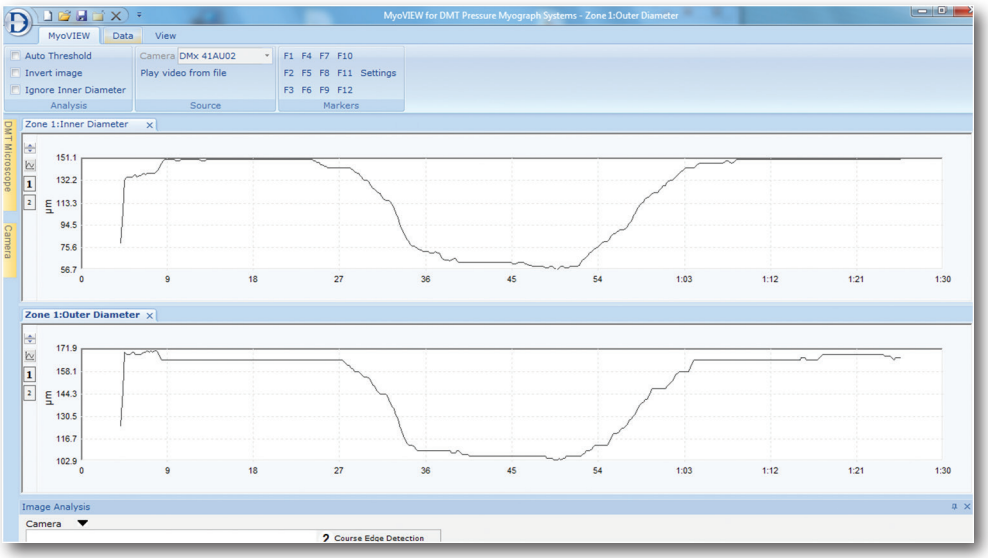


Figure 3.8 *Trace Layout 3 - Rows Layout*

3.3.1 Setting of the Y-axis

Click on the Y-axis icon at the left hand side.

It will open a **Y-axis setting menu** as shown below.

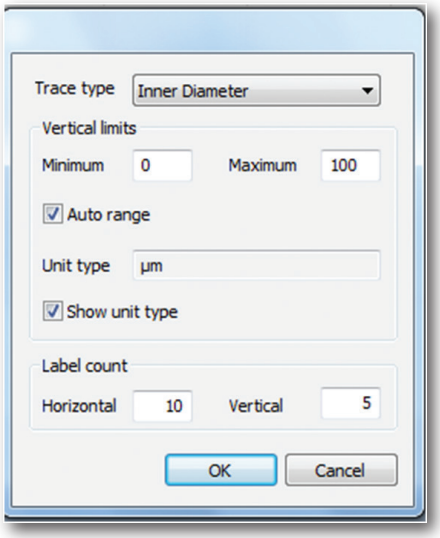


Figure 3.9 *Y-axis setting menu*

- **Trace Type -** Select the parameter to be shown.
- **Vertical limits -** Enter the minimum and maximum Y-value.
- **Auto range -** Will at all time scale the Y-value data shown in the trace automatically.
- **Unit type -** Measure unit. This cannot be changed but shows the unit of the given parameter.
- **Show unit type -** Will show the unit of the given parameter on the y-axis of the trace e.g. inner diameter will show µm
- **Label count -** The distance between tick marks on the y and x axis can be entered.

Move Y-axis up or down

Scrolling the mouse wheel moves the Y-axis up or down. This is a fast and easy way to get the trace in the center of the viewing field on a given trace, or click on the UP and DOWN arrow icons to move the Y-axis up or down.

3.4 Menus

In the MyoVIEW program there are three main menus in the toolbar: **MyoVIEW**, **Data** and **View**, marked in figure 3.10 below.

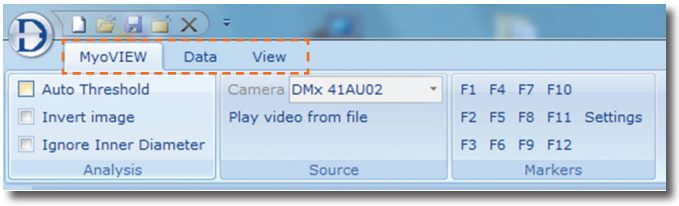


Figure 3.10 *MyoVIEW Menus*

3.4.1 MyoVIEW Menu

In the **MyoVIEW Menu** there are three submenus: **Analysis Menu**, **Source Menu** and **Markers Menu**.

3.4.1.1 Analysis submenu

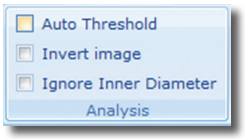


Figure 3.11 *Analysis submenu*

- **Auto Threshold** - Selecting Auto Threshold will disable the manual setting of the tracking parameters in the tracking algorithm and use the default parameters. The Auto Threshold will only be optimal for very clean vessels.
- **Invert Image** - Invert the pixel values on the video input making white black and visa versa.
- **Ignore Inner Diameter** - The inner diameter will not be calculated. This should normally be selected for very thick vessels as e.g. aorta where tracking of the inner diameter is very difficult.

3.4.1.2 Source submenu

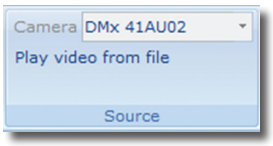


Figure 3.12 *Source submenu*

- **Camera** - Selection of camera (for now DMT only support one type of camera)
- **Play video from file** - A recorded video file from e.g. a former pressure experiment can be loaded, shown and also reanalyzed using MyoVIEW.

NOTE
THE GAIN, BRIGHTNESS AND GAMMA VALUES CANNOT BE CHANGED ON A RECORDED VIDEO FILE.

3.4.1.3 Markers submenu

Figure 3.13 *Markers submenu*

- **F1 - F12** - Linked to predefined Marker Strings.
- **Settings** - Enter Marker text for the given Hotkeys.

In MyoVIEW markers can be added to the traces in two ways. To enter a free text at a given position in a trace, double click on the trace and this will open a text box as shown on next page.

Enter any given text of choice and press **Save message** or press the ENTER key.

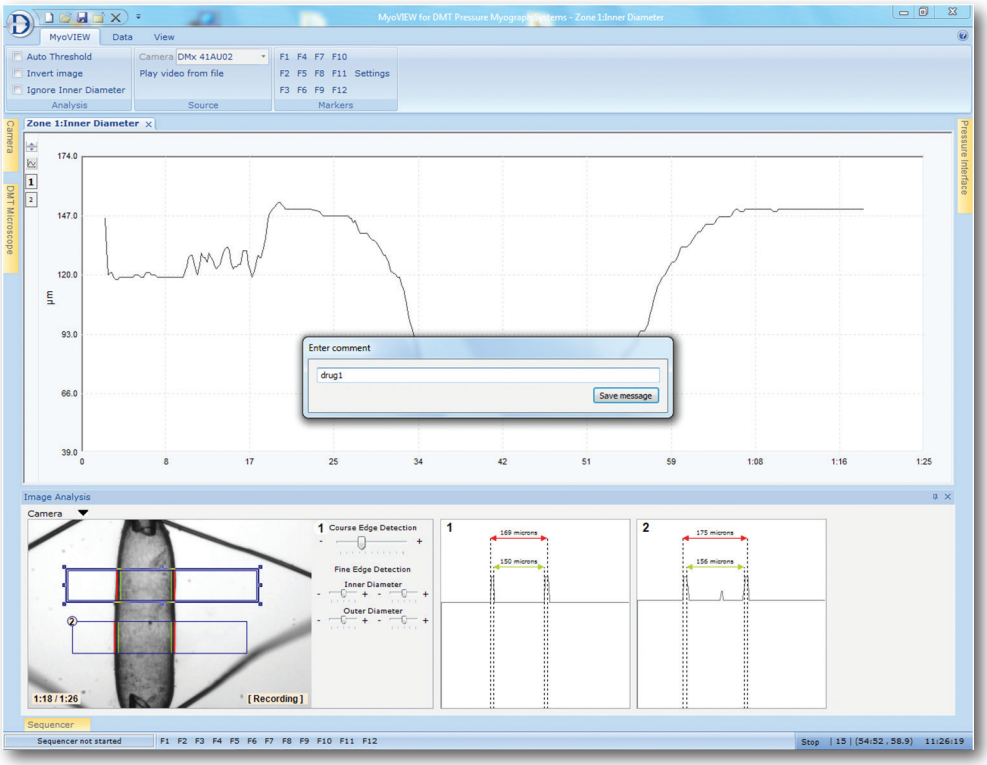


Figure 3.14 *Markers - enter free text*

The entered text will be shown at the given position in the trace as marked in figure 3.15 below.

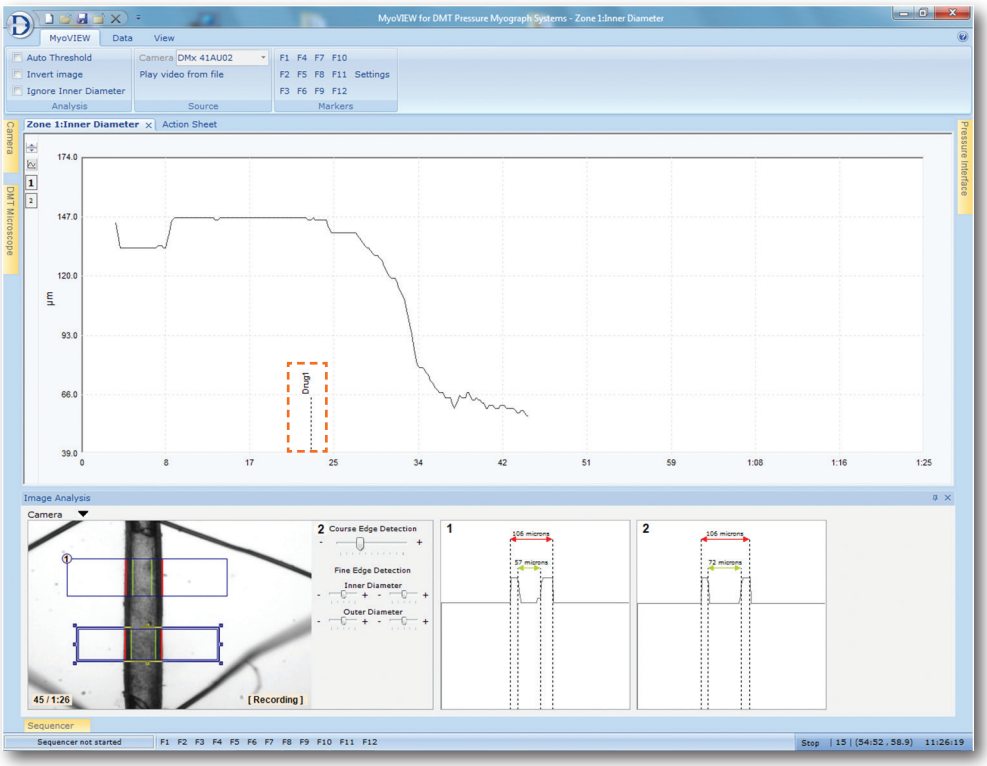


Figure 3.15 *The entered text shown at a given position*

The other possibility in MyoVIEW is to predefine Marker text and link them to Hotkeys. This functionality is very useful for Marker text used again and again. In the **Markers submenu** press settings and the dialog box below will be shown.

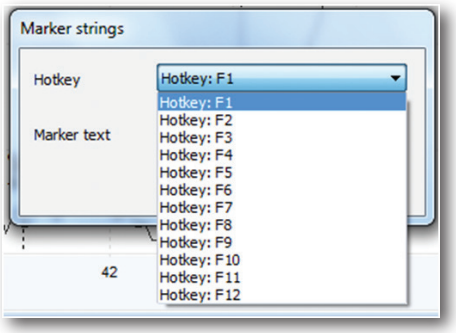


Figure 3.16 *Marker strings*

Here the Hotkey (Function key) is selected and the appropriate text linked to a Hotkey is entered. Below the text 'Drug 1' has been connected to Hotkey F1. Every time the F1 Hotkey is pressed during an experiment the text 'Drug 1' will be added to the trace as a marker at the given time.

There is in total 12 Hotkeys (F1 - F12) that can be predefined with a user selected Marker text of choice.

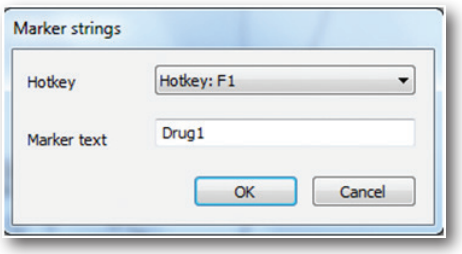


Figure 3.17 *Hotkey*

3.4.2 Data Menu

In the **Data Menu** there are three submenus: **Export**, **Delete** and **Video Recording**.

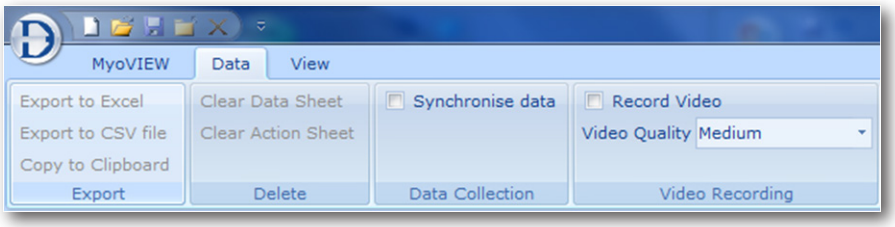


Figure 3.18 *Data Menu*

3.4.2.1 Export submenu

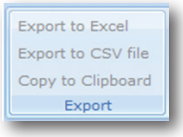


Figure 3.19 *Export submenu*

- **Export to Excel** - This submenu will export all the data selected in the Data Sheet into Excel. By clicking **Export to Excel** Excel (only if installed on the computer) opens up and all data from the MyoVIEW data sheet will be exported into an Excel sheet.

- **Export to CSV file** - This submenu will export data in the Data Sheet into a comma separated file. By clicking the **Export to CSV** file icon the following will be shown if different export types (Mean, Maximum and Minimum) have been used to generate the data in the Data Sheet.

  Select the data sets to export and save the CSV file.

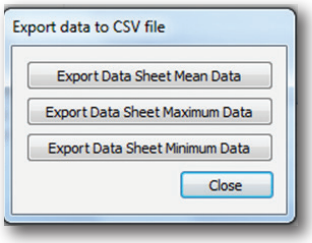


Figure 3.20 *Export data to CVS file*

- **Copy to clip board** – This function will copy the data in the data sheet to the clip board and can then be pasted into an appropriate program as e.g. Word, Excel and PowerPoint.

3.4.2.2 Delete submenu

- **Clear Data Sheet** - This will delete all the data in the Data Sheet.

  NOTE
  THE DATA FROM THE DATA SHEET CANNOT BE RECOVERED IF 'CLEAR DATA SHEET' IS USED.

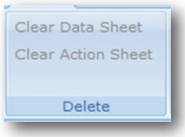


Figure 3.21 *Delete submenu*

- **Clear Action Sheet** - This will delete all the data in the Action Sheet.

  NOTE
  THE DATA FROM THE ACTION SHEET CANNOT BE RECOVERED IF 'CLEAR ACTION SHEET' IS USED.

3.4.2.3 Data Collection submenu

- **Synchronize data** - This make sure that all recorded data is synchronized in respect to time. MyoVIEW will check for hardware connected (Pressure Interface, Camera, Flow meter) and dependent on the hardware identified the maximum data collection rate possible will be set and all parameters will be recorded as synchronized data sets in respect to time. The actual set sampling rate will be written in the action sheet as shown in figure 3.23 below. The data will be recorded as synchronized data as soon as the **Synchronise data** box is checked. When the **Synchronise data** box is unchecked all incoming data will be collected at maximum speed for each parameter and a line in the Action Sheet with the text Data Samples not synchronised will be added with a time stamp.

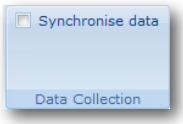


Figure 3.22 *Data Collection submenu*

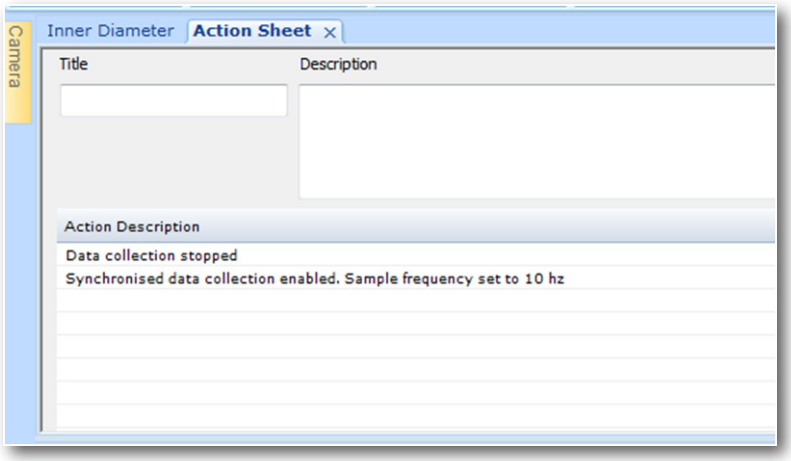


Figure 3.23 *The actual set sampling rate written in the action sheet*

3.4.2.4 Video Recording submenu

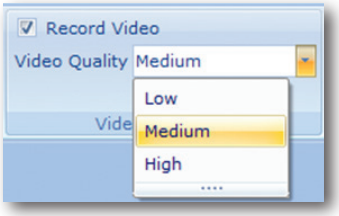


Figure 3.24 *Video Recording submenu*

- **Record Video** - Selected if the video signal from the USB camera should be saved together with all the trace recordings of an experiment. If this is not selected you will not be able to start video recording during your experiment without first stopping the Video Capture, save the data and start a new file.

  VERY IMPORTANT
  IF THE VIDEO FILE OF THE EXPERIMENT SHOULD BE SAVED IT IS EXTREMELY IMPORTANT TO SELECT 'RECORD VIDEO' BEFORE STARTING THE VIDEO CAPTURE IN THE 'CAMERA CONTROL WINDOW'.

- **Video quality** - The video of the experiment can be recorded in three qualities; Low, Medium and High. The size of the recorded video file will increase significantly from a low to a high quality file. An example is given here:

  A 10 minutes video file size:

  - Low quality: 10MB
  - Medium quality: 50MB
  - High quality: 150MB

  Free disk space availability on the computer should be considered before selecting the quality of the recorded video.

3.4.3 View Menu

In the **View Menu** there are five submenus; **Application layout, Data Analysis, Live Traces, Trace Selection** and **Zone Colors**.

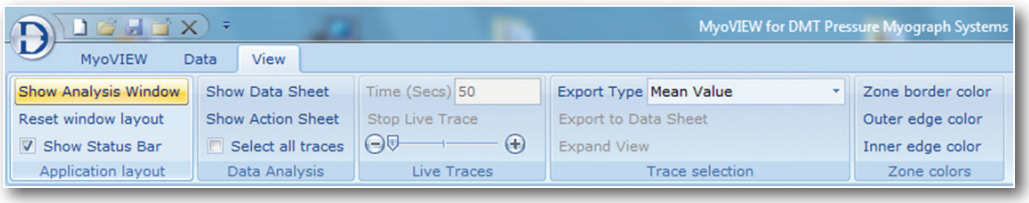


Figure 3.25 *View Menu*

3.4.3.1 Application Layout submenu

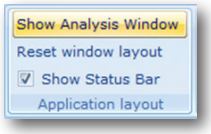


Figure 3.26 *Application Layout submenu*

- **Show Analysis Window** – Will open up the **Image Analysis window** (Video from camera) if closed by the user.
- **Reset Window Layout** – Return the MyoVIEW layout to the default layout. Very useful in situations where the layout needs to be 'cleaned up'.
- **Show Status Bar** – The status bar is the bar at the bottom of the screen showing the Hotkey's F1-F12.

3.4.3.2 Data Analysis sub menu

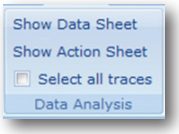


Figure 3.27 *Data Analysis submenu*

- **Show Data Sheet** - Open the Data sheet
- **Show Action Sheet** - Open the **Action Sheet**. The action sheet will list all the events as e.g. camera calibration, sequencer tasks, markers etc.
- **Select all traces** - To transfer data from all open traces for the same time frame the **Select all traces** are selected. When one time frame is selected in one trace all open traces will have the same time frame. If this is followed by clicking on the **Export to Datasheet** in the **Trace Selection submenu** then the data from all the open traces for the selected time frame will be transferred to the Data Sheet.
  To transfer only the data from one given trace and time frame the **Select all traces** is NOT selected. When the **Export to Datasheet** in the **Trace Selection submenu** is selected only data from the selected trace and time frame is transferred to the data sheet.

  Select all traces is marked. Followed by **Export to data Sheet** will transfer data to the data sheet from all the selections shown in figure 3.28.

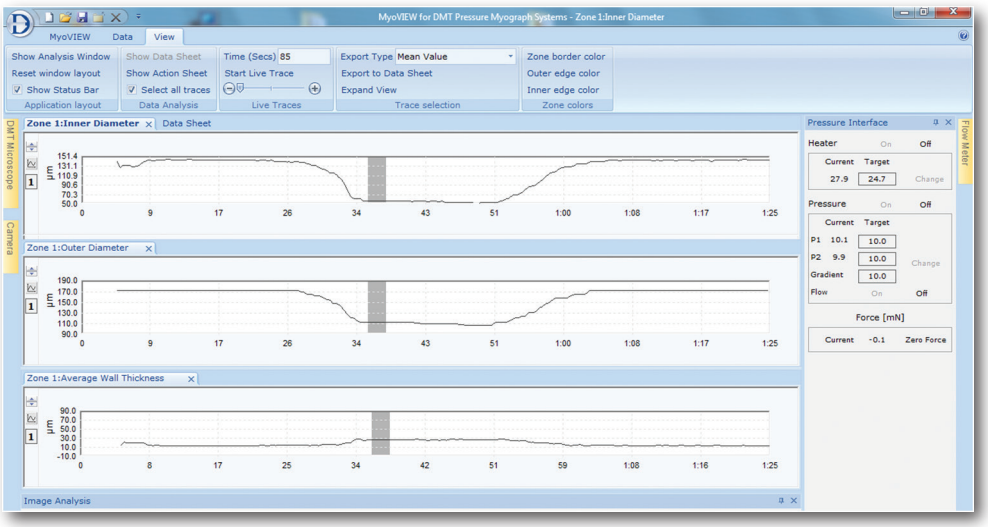


Figure 3.28 *Selection of all traces*

See **Data Sheet** marked in figure 3.29 below.

Figure 3.29 *Export of data sheet of all traces*

When **Select all traces** is NOT marked as shown below **Export to data Sheet** will only transfer data to the data sheet from the selection shown in the given trace.

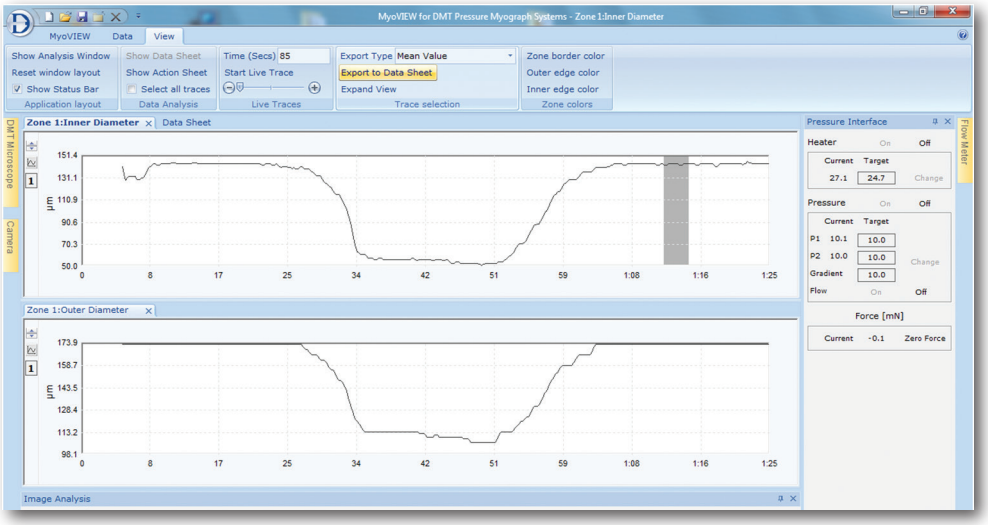


Figure 3.30 *Selection of the given trace*

See **Data Sheet** marked in figure 3.31 below.

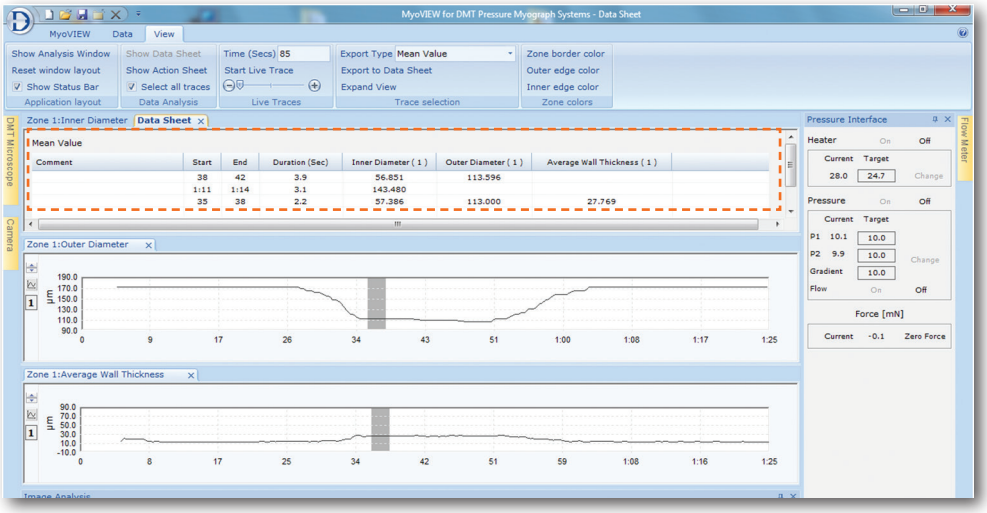


Figure 3.31 *Export of data sheet of one given trace*

3.4.3.3 Live Traces submenu

- **Time (secs)** - Number of seconds shown on the recording traces. If 100 seconds is typed in then the last 100 seconds of the running traces are shown.
- **Start Live Trace/Stop Live Trace** - Stop Live Trace will stop the refreshing of the trace and let the current trace 'freeze' making it possible to look carefully at a part of the curve while the data still being recorded. Start Live trace will always show the 'front' of the trace where new data is being recorded into the trace.
- **Scrolling Bar** - The scrolling bar is used to scroll through the traces. Press the minus to scroll back in time and the plus to scroll forward in time. Alternative move the slider toward the minus or plus to scroll back and forth in time respectively.

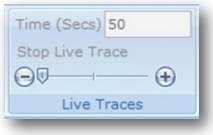


Figure 3.32 *Live Trace submenu*

3.4.3.4 Trace selection submenu

- **Export Type** - Selection of the data transformation type to be carried out on the selected data:
  - Mean Value: Calculate the mean value of the selected data
  - Maximum Value: The highest value in the selected data set
  - Minimum Value: The lowest value in the select data set

- **Export to Data Sheet** - Transfer the Mean, Maximum or Minimum value (depending on the selected Export Type) to the Data Sheet.

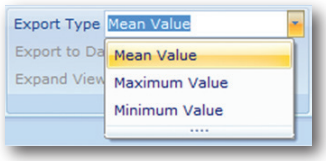


Figure 3.33 *Trace selection submenu - Export type*

IMPORTANT
BEFORE EXPORTING DATA TO THE DATA SHEET SELECT THE "SELECT ALL TRACES" IN THE DATA ANALYSIS MENU IF DATA FOR THE MARKED TIME FRAME FROM ALL OPEN TRACES SHOULD BE EXPORTED TO THE DATA SHEET. OTHERWISE ONLY THE MARKED TRACE WILL BE EXPORTED.

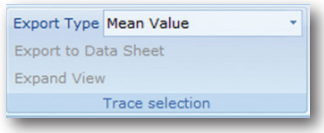


Figure 3.34 *Trace selection submenu*

- **Expand View -** Zoom function. Select a time frame (>5 sec) and press EXPAND VIEW -> the selected time frame will be expanded to fill the whole viewing field of a trace e.g. a selected time frame of 90 sec will by pressing EXPAND VIEW result in traces where maximum the last 90 seconds of the traces can been seen on the screen at any given time. When pressing EXPAND VIEW the selected time frame will be transferred to the Time field in **Live Traces submenu**

3.4.3.5 Zone colors sub menu

- **Zone Border color** - Select the color of the Zone box wherein the vessel dimension should be measured.
- **Outer edge color** - Select the color of the tracking bar for the outside wall position of the mounted vessel.
- **Inner edge color** - Select the color of the tracking bar for the inside wall position of the mounted vessel.

Figure 3.35 *Zone colors submenu*

CHAPTER 4 - DATA COLLECTION AND SAVING DATA

MyoVIEW will not record and save data for any parameters before the **Start recording data button** is pressed at the status bar of MyoVIEW shown in figure 4.1 below. MyoVIEW will in the traces write “Data Not Saved” as long as the **Start button** is not activated as an indication of that the incoming data will not be collected and saved.

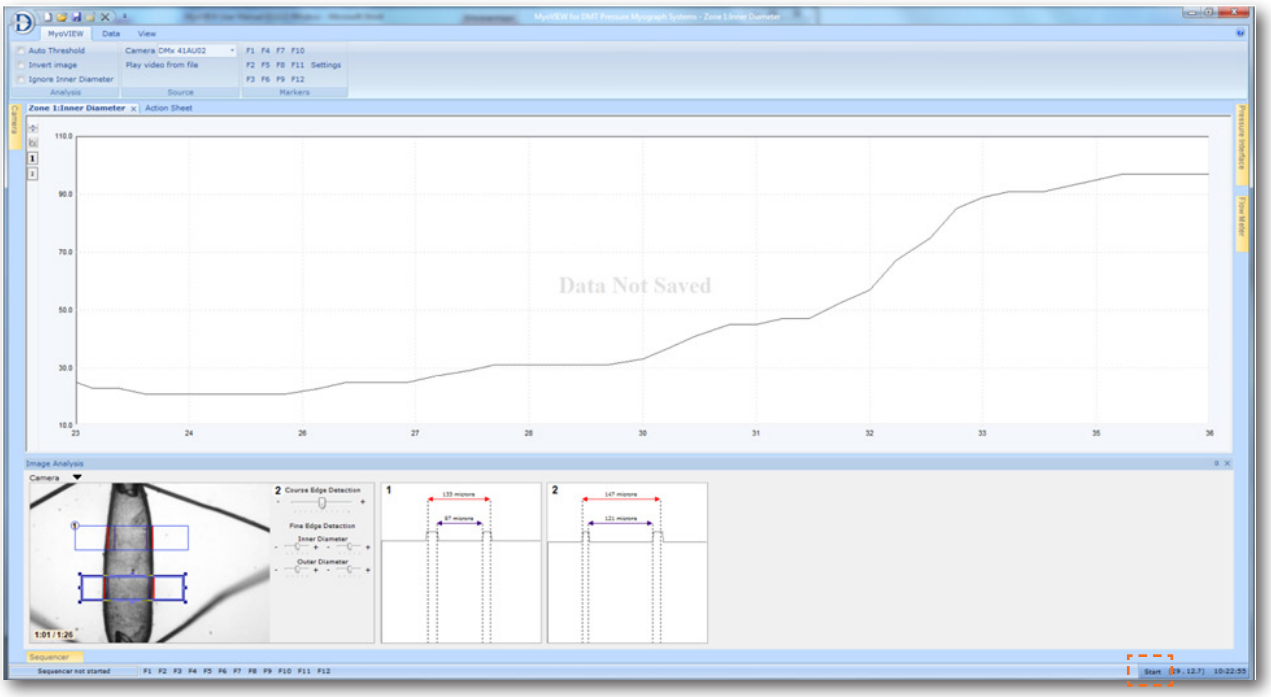


Figure 4.1 *Start recording data button*

Pressing the **Start button** will reset the time to zero and the traces shown and the **Start button** will change to a **Stop collecting data button** as showed in figure 4.2 below.

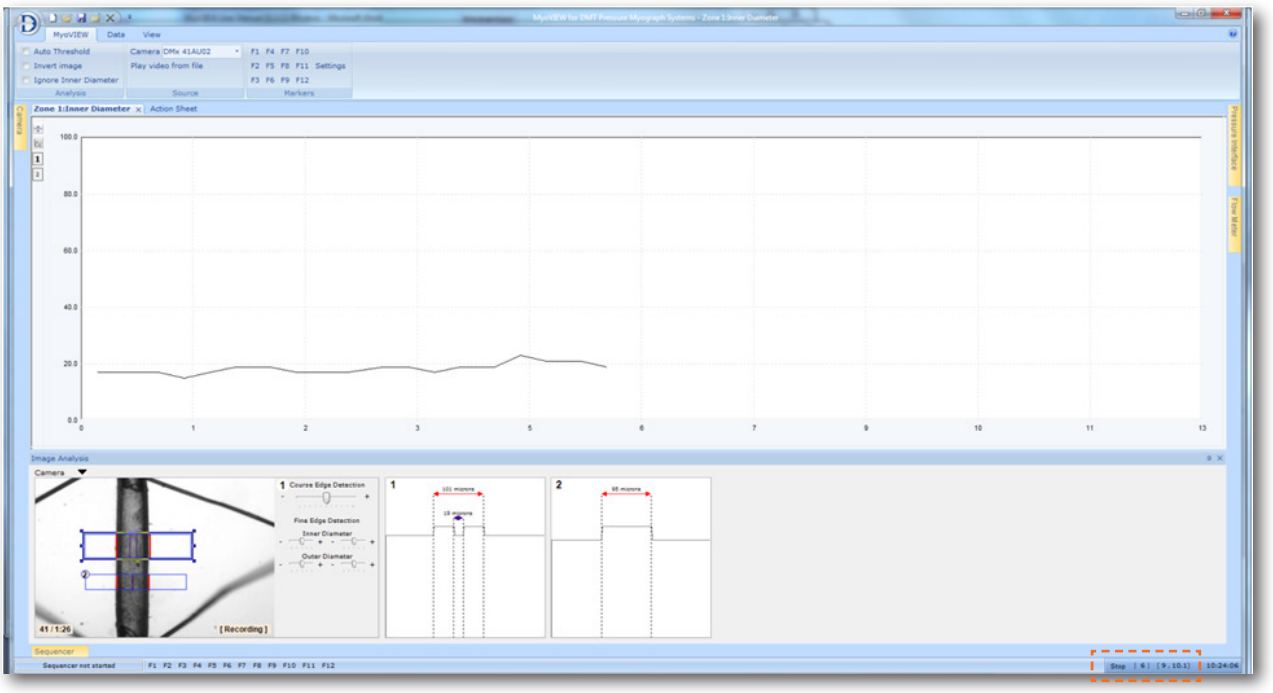


Figure 4.2 *Stop collecting data button*

The data will now be recorded and saved in MyoVIEW until the **Stop recording data button** is pressed. When the **Stop recording button** is pressed a marker will be shown in the trace with the text "Data Collection stopped" and in the Action Sheet (see figure XX) a line will be entered with the text Data Collection stopped with a time stamp. Furthermore, all traces will show the text Data Not Saved when the Stop button has been pressed or the Start button not activated.

If the **Start collecting data button** is activated again after it has been stopped using the **Stop button** MyoVIEW will ask if the former recorded data should be saved in a file or discarded.

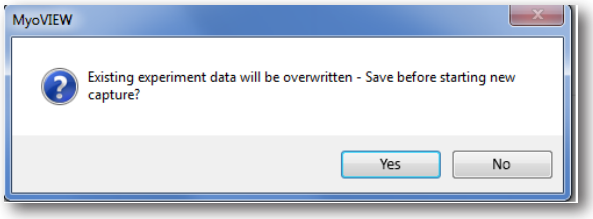


Figure 4.3 *Warning message - save*

If the data should be saved enter a title of the experiment and a description of the experiment as shown in figure 4.4 below. Press save.

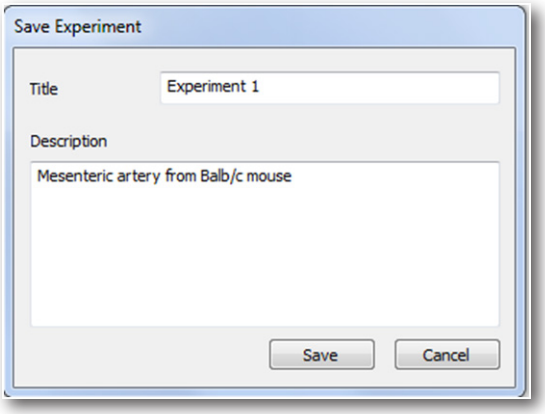


Figure 4.4 *Save Experiment*

Enter a filename and the location on the computer where the file should be saved. After reactivating the Start button and saving the former data MyoVIEW will zero the time, reset the trace and start collecting and saving the new data.

CHAPTER 5 - DATA ANALYSIS AND EXPORT

MyoVIEW will record and save data for all parameters during an experiment. Open a given experiment and data file in MyoVIEW. The open file will show you the same layout as shown when the file was saved. Below is an example.

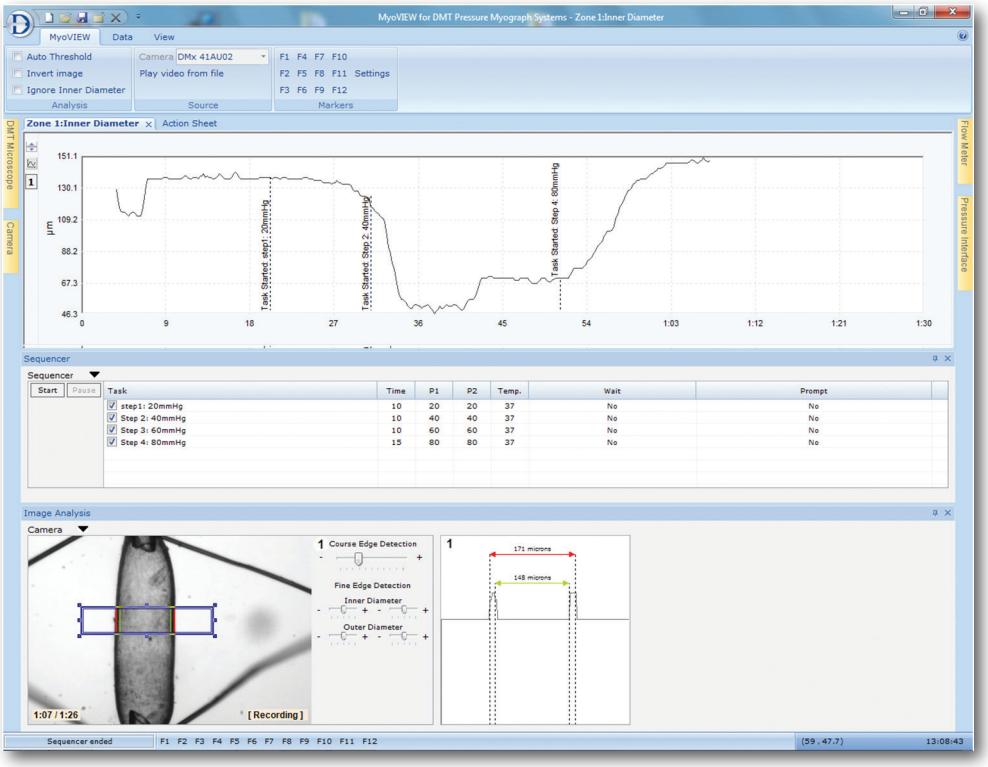


Figure 5.1 *Example of an open file*

To look at other parameters of the experiment:

- Open a new trace and right click on the trace to select the parameter of choise.
- Select zone 1 or zone 2 and eventually adjust the y-axis to see the recorded trace for the given parameter.

Scroll through the traces and recorded video by adjusting the time in the **View Menu** and by using the scrolling function (see chapter 3.4.3.3 and figure 5.2 below). The video of the experiment will be shown in the **Camera Control window** if Record Video was selected before the video capture was started. Scrolling through a trace using the scroll function will show the trace parameter data as well as the recorded video image at the given time as seen in figure 5.2 below.

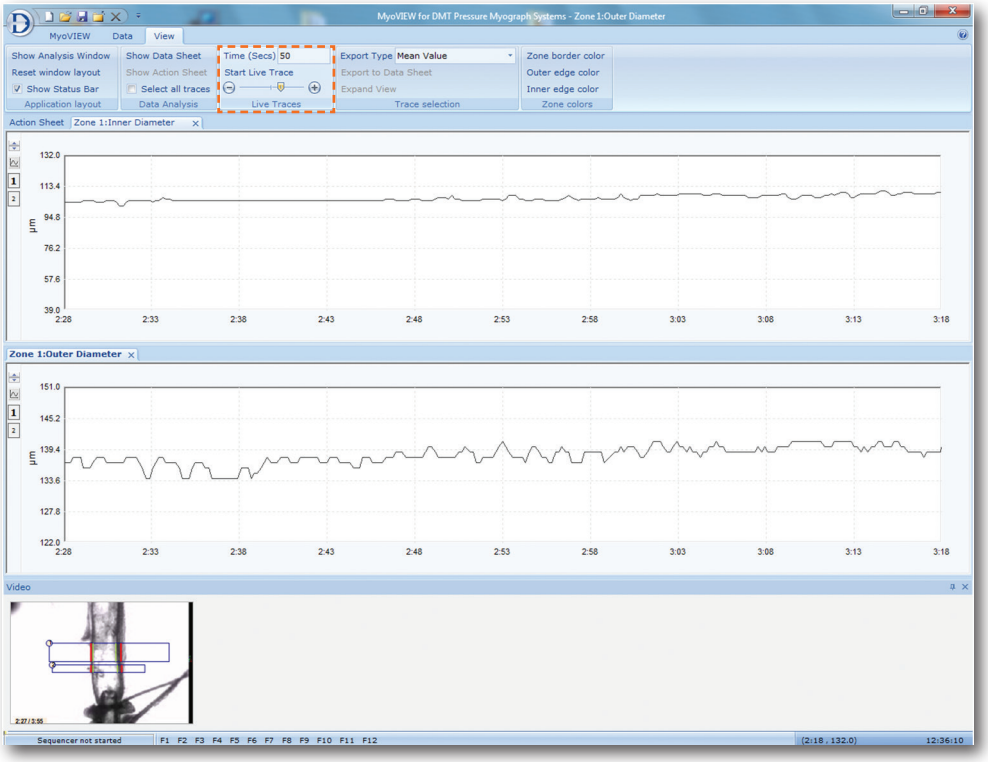


Figure 5.2 *Scrolling through the data using the scroling bar in the Live Traces submenu, shows the traces as well as the corresponding video with the two zones.*

Export the data of interest to the MyoVIEW Data Sheet as described in chapter 3.4.2.1. All the collected data in the MyoVIEW Data Sheet can be exported to a CSV or Excel/Word/WordPad. The Raw Data can be exported to alternative programs for data analysis (see below).

Export of raw data:
Export of raw data to Excel, Word, or WordPad: Select/mark a given part or the whole trace. Drag the selected part to Excel/Word/WordPad. The exported raw data will be shown in two columns where the first column always are the time and the second column the given parameter of the selected trace.

Export of raw data to a CSV file (comma separated file):
Select/mark a part of a trace or the whole trace. Drag the selected part while holding down the ALT key to an appropriate folder. The CSV file will be given an arbitrary file name. Rename the file if wanted. The exported raw data will be shown in two columns where the frist column always are the time and the second column the given parameter of the selected trace.

Export Video Image:
The image shown in the Camera Control window can be exported either as an image file bescribed in chapter 2.3.4 and as shown in figure 2.18 or drag the image in the Camera Control window to e.g. Word, Powerpoint, Excel, Wordpad etc while pressing the SHIFT key.

APPENDIX 1 - PARAMETER FORMULAS USED IN MYOVIEW

MyoVIEW performs several measurements and calculations relevant to vascular physiology. These measurements and calculations are based on raw inputs (data from the flow meter and pressure interface), as well as vessel dimension outputs. The following is a list of the formulas used to calculate real-time parameters and how they are relevant to vessel physiology and vascular function.

WALL THICKNESS

$(D_e-D_i)/2$

D_e is the outer or external diameter of the vessel and D_i is the luminal or inner diameter. Wall thickness can be used as an index of vascular hypertrophy; the thicker the wall, the greater the degree of hypertrophy.

CROSS SECTIONAL AREA

$(\pi/4)*[(D_e)^2 - (D_i)^2]$

D_e is the outer or external diameter of the vessel and Di is the luminal or inner diameter. Similar to wall thickness, cross sectional area can be used as an indication of hypertrophy or vascular wall remodeling.

MEDIA/LUMEN RATIO

$(D_e - D_i)/(D_i)$

D_e is the outer or external diameter of the vessel and D_i is the luminal or inner diameter. The media/lumen ratio is indicative of morphological changes and can be used along with wall thickness and cross sectional area to determine the particular form of hypertrophy.

MEAN PRESSURE

$(P_{in}+P_{out})/2$ or $(P_1+P_2)/2$

P_{in} or P_1 is the input or inlet pressure and P_{out} or P_2 is the output or outlet pressure. The mean pressure is the average of the inlet and outlet pressures. It is necessary to monitor when flow is induced by a pressure gradient or differential between P_1 and P_2. Mean pressure should be constant when measuring flow-mediated dilation to verify that increases in vessel diameter are flow-induced and not pressure induced.

VASCULAR RESISTANCE

P_{diff}/Q

P_{diff} is the pressure difference and Q is the flow volume. The vascular resistance is the force opposing the movement of solution through a vessel. It is inversely proportional to the vessel radius to the 4^{th} power. A greater vascular resistance will require a greater degree of vasodilation in order to maintain constant pressure within the vessel.

SHEAR STRESS

$(8*\eta*V)/D_i$

The constant, η, (or eta, sometimes represented as μ, or mu) is the dynamic viscosity, V is the flow velocity and Di is the inner diameter of the vessel. Shear stress is a characterization of the frictional drag exerted on arterial walls during flow. Many physiological functions are influenced and promoted by this biomechanical force. Normal levels of shear stress serve to maintain wall physiology. High shear stress triggers vascular dilation in order to regulate the mechanical forces exerted on arterial walls.

APPENDIX

The following example is given for water at 37 °C to help with the conversion of input to intermediate to output units. Input units will be determined by either the hardware attached or the task set up in the software. For example, all units of length will input as micrometers if the dimensioning task is set up this way in the task manager. The output units were taken from a survey of the primary literature. The selection of intermediate units is personal preference. In this example, "cgs" units have been chosen (i.e., centimeters, grams and seconds) as the intermediate units because most of the output values taken from the literature use cgs standards, such as dynes.

VESSEL FLOW RECORDING TASK

Intermediate units

Length (cm):		Mass (g):		Time (sec.):	

Solution presets constants

Density (9.937e-1) :	g/cm^3	Viscosity: 6.904e-4	g/(cm x s)

UNIT CONVERSIONS

Input Units to Intermediate Units Conversions

	Input Units	Slope	Inter. Units
Volume Flow (Q)	µl/min	1.667e-5	cm^3/s
Inner Diameter (D_i)	µm	1.000e-4	cm
Inner Area (A_i)	µm^2	1.000e-8	cm^2
Inlet Pressure (P_{in})	mm Hg	1.333e3	g/(cm*s^2)
Outlet Pressure (P_{out})	mm Hg	1.333e3	g/(cm*s^2)

Intermediate Units to Output Units Conversions

	Inter. Units	Slope	Output Units
Flow Velocity	cm/s	1	cm/s
Mean/Diff. Pressure	g/(cm*s^2)	7.501e-4	mm Hg
Vascular Resistance***	g/(cm^4*s)	1	(dyne*s)/cm^5
Vascular Resistance***	g/(cm^4*s)	0.100	(MPa*s)/m^3
Shear Stress	g/(cm*s^2)	1	dyne/cm^2

**** Vascular Resistance is commonly reported in either (dyne*s)/cm^5 or (MPa*s)/m^3, or both.*

FOR FURTHER READING

Kristopher S Cunningham and Avrum I Gotlieb. The role of shear stress in the pathogenesis of atherosclerosis. Laboratory Investigation (2005) 85, 9–23. (Please note that the units given for Re in this reference are wrong.

APPENDIX 2 - MYOVIEW UPGRADES OR CHANGE LICENSE

MyoVIEW upgrades is free within the same version number e.g. if version 3 has been purchased all upgrades up to version 3.9.9 will be free of charge. When DMT release a new version number a complete installation of new the MyoVIEW version will be performed keeping the old version.

A question mark icon is shown in MyoVIEW in the right corner (see figure A2.1). Clicking this icon will open the **License Manager** of MyoVIEW as seen in figure A2.1 below. Here the license version installed can bee seen. Furthermore the MyoVIEW license can be either upgraded or changed.

Upgrade license
This is used for upgrading MyoVIEW with modules in the the basic version of MyoVIEW e.g. as the FlowMeter Module. A new license code will follow and be delivered with an investment in a FlowMeter as a new module for the Pressure Myograph System. The MyoVIEW license will have to be upgraded with this new license.

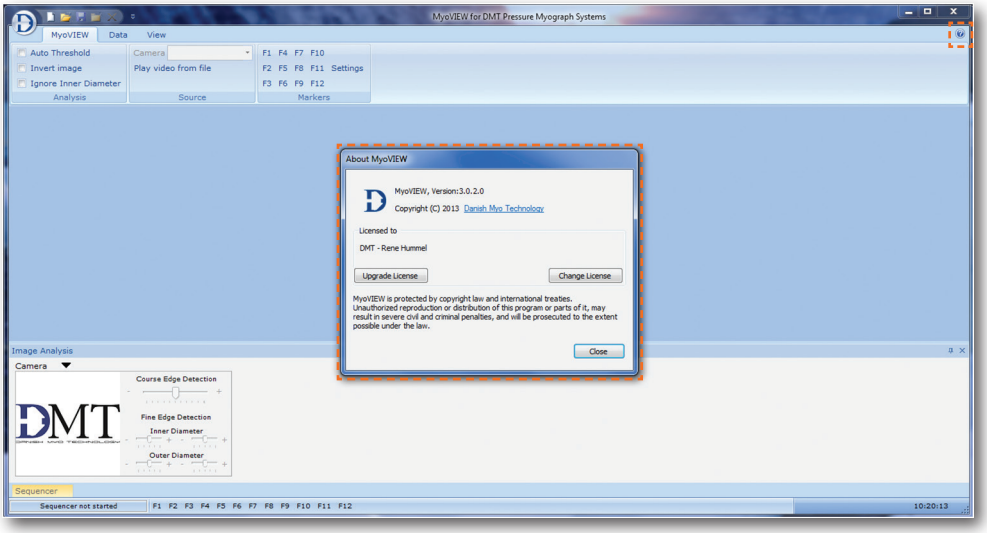


Figure A2.1 *Upgrade or change MyoVIEW licens*

Change license
Used to shift between MyoVIEW for the Pressure Myograph System and the Culture Myograph System.

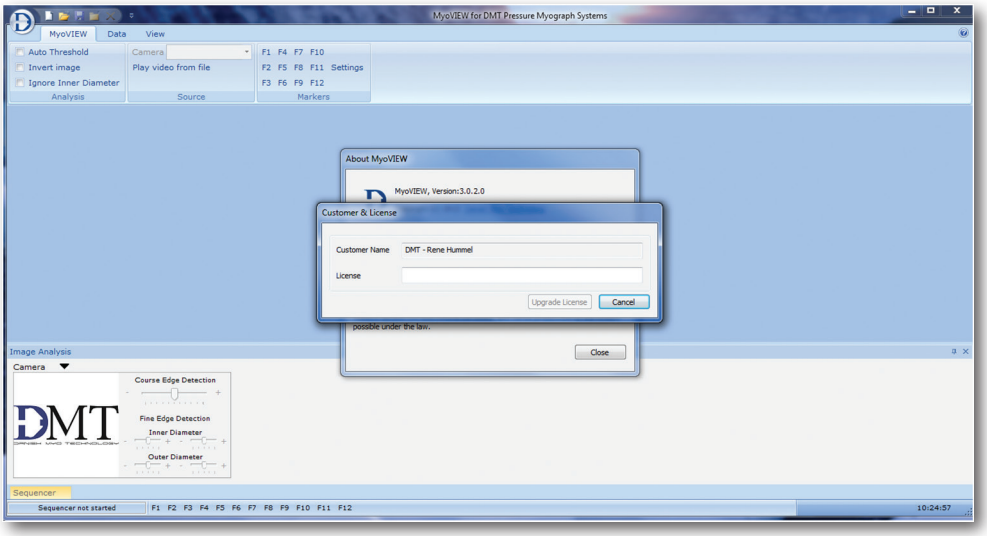


Figure A2.2 *Change license*

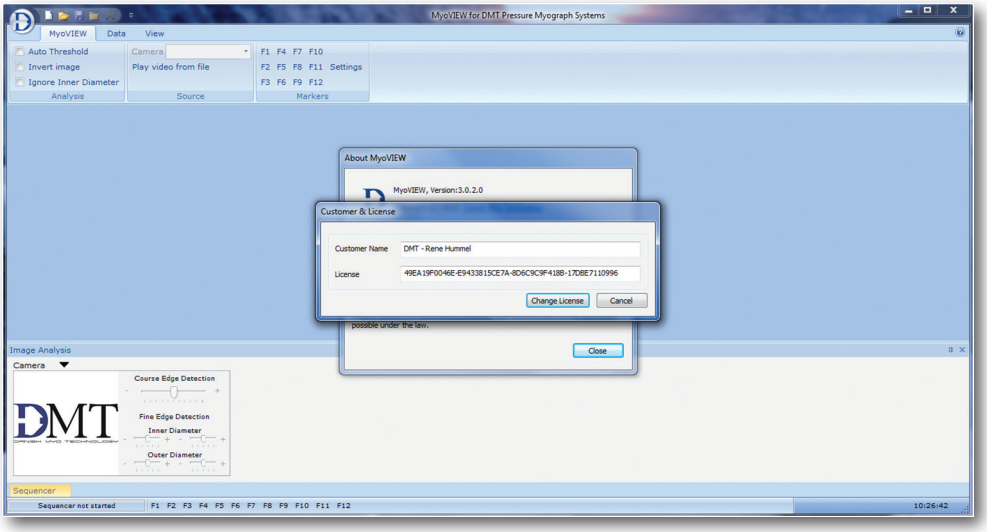


Figure A2.3 *Fill in license and click "change license"*

NOTES

Aalborg Hospital South • Academic Medical Center Amsterdam • Academy of Sciences of the Czech Republic • Actelion Pharmaceuticals Ltd • Ahmadu Bello University • Akzo Nobel/Organon • Albert Einstein College of Medicine • Albert-Ludwigs-Universität Freiburg • Arete Therapeutics • Aarhus Kommunehospital • Arizona State University • Asterand UK Ltd. • Aston University • AstraZeneca • AstraZeneca R&D Mölndal • Aventis Pharma • Bayer HealthCare AG • Baylor College of Medicine • Bristol-Myers Squibb • Brock University • Bulgarian Academy of Sciences • Campus Charité Mitte • Cardiff University • Case Western Reserve University • Charles University • Childrens Hospital of Pittsburgh • Chinese University of Hong Kong • Christian-Albrechts-Universität zu Kiel • Clinica Medica, PUGD Udine • CNRS d'Orléans • CNRS UMR 6097 • Columbia University • Copenhagen Hospital Glostrup • Copenhagen University • Cork University Maternity Hospital • Cornell University • Coventry University • CV Therapeutics Inc. • Cytokinetics Inc. • Daegu Catholic University • Deakin University • Der Universität Freiburg • Der Universität Im Neuenheimer Feld 326 • Deutsche Forschungsgemeinschaf (DFG), Bonn • Duke University • Duke University Pharmacology • Dundalk Institute of Technology • East Carolina University • Eastern Virginia Medical School • Ecole Polytechnique Fédérale De Lausanne • Ege University • Emory University • Emory University, School of Medicine • Erasmus Universiteit Rotterdam • Federal University of Minas Gerais • Ferring Research Institute Inc. • Florida Atlantic University • Florida International University • Forschungsverbund Berlin E.V. • Fourth Military Medical University • Franz-Volhard-Clinic • Free University Berlin • Freie Universität Berlin • Friedrich Schiller University • Fudan University • Georgetown University • Glasgow Caledonian University • Glasgow University • GlaxoSmithKline • Glenfield Hospital • Göteborg University • Grand Vally State University • Harefield Hospital • Harvard Medical School • Harvard University • Hebei Medical University • Henry Ford Health System • Hospital Clinic (Barcelona) • Hospital Lariboisiere • Hospital Ramón y Cajal (Madrid) • Hospital Universitario de Getafe (Madrid) • Hospital Universitario La Fe (Valencia) • Hospital Universitario Virgen del Rocío (Sevilla) • Humboldt Universität zu Berlin • ICBM University of Chile • Imperial College London • Indiana University • INSERM U541 • INSERM U637 • INSERM U644 • INSERM U772 College de France • Inserm U858 • Institut de Pharmacologie Moléculaire et Cellulai • Institut De Recherches Cliniques De Montréal • Institute of Cellular Biology and • Institute of Immunology & Physiology • Istanbul University • J.W. Goethe-Universität • Jagiellonian University • James Cook University • Johann-Wolfgang-Goethe-Universität • Johns Hopkins University • Juntendo University • Justus-Liebig-Universität Giessen • Kaohsiung Medical University • Karolinska Institute • KAS Glostrup • Katholieke Universiteit Leuven • King's College London • King's College London GKT School of Medicine • KK Women's and Children's Hospital • Klinikum Der Universität Zu Köln • København Universitet • Korea University • Laboratorios Almirall (Barcelona) • Linköping University • Liverpool University • Loma Linda University • Loyola University At Chicago • Ludwig Maximilians University • Lund Universitet • Lundbeck Pharmaceuticals • Luther College • M.V.Lomonosov Moscow State University • Manchester Royal Infirmary • Manchester University • Manitoba Institute of Child Health • Marquette University • Martin-Luther Universität Halle-Wittenberg • Massachusetts General Hospital • Max-Delbrück-Centrum • Mayo Clinic • McMaster University • MDC Berlin • Medical College of Georgia • Medical College of Wisconsin • Medical University of South Carolina • Memorial University Of Newfoundland • Michigan State University • Mogiglass Artigos Para Laboratorio LTDA • Monash University • Mount Sinai School of Medicine • Nanyang Technological University • Nat. 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